SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXIV.—No. 2. [NEW SERIES.] | NEW YORK, JANUARY 7, 1871. | $3 per Annum. [IN ADVANCE.]

Mammoth Cylinder Lithographic Machine.

Our engraving is a representation of the largest lithographic press in America. It was manufactured by Hughes & Kimber, of London. Victor E. Mauger, No. 110 Reade street, New York, is agent for the sale not only of this machine, but also of the Wharfedale two-feeder printing press, not long since illustrated and described in this journal, together with lithographic materials, improved engines, cutting machines, etc., full particulars of which are specified in our advertising columns, to which the reader is referred.

Although this is the largest-sized machine of the kind yet built, the manufacturers are prepared to build still larger if desired. Such large presses are very useful in the printing of posters, maps, etc. We are informed by the firm in whose establishment the monster press is now running, that independent of a low bid for a government contract for map printing, they were awarded the contract because they could, on this press, print the map on a single sheet, and thus avoid subsequent piecing, which could not be done with any other press in the country.

Various sizes of this press are made, running down to those much smaller than the particular one under consideration. They are all precisely similar except in size, although size will, in the sequel, be shown to be a very important point. It will, of course, be impossible to go into minute details. Our purpose will be sufficiently accomplished by a comparison of the old method of lithographic printing with the present. To do this we will attempt to place before the reader a general outline of the art of lithography, than which no process has more points of general mechanical and scientific interest. We have before given a brief sketch of this process, but at the risk of repetition we will, at this time, dwell somewhat more minutely on its details.

The word lithography means the art of tracing letters, figures, and other designs on stone, and transferring them to paper by impression. This art has really nothing in common with engraving, as the surfaces printed from are perfectly smooth, having neither lines in relief nor lines sunk into the surface of the stone, except such as are uniformly distributed over the entire surface, by what is called the "graining" process—a slight roughening done by rubbing the surface with a muller of the same kind of stone, and silver sand of various degrees of fineness. For some kinds of work the stones are polished with pumice stone.

The stones employed are fine *oolite*, obtained chiefly from the interior of Germany. After graining, the design is drawn upon the stone with oily ink or crayons. If different colors are to be used in the same design, as many different stones as colors must be employed; and no single one of the stones has traced upon it the entire design, but only such a portion as is to be printed in one particular color.

The printing from stone in different colors has been appropriately called chromo-lithography, an art which has, through the aid of the press under consideration, risen to a rank second only to fine oil-painting.

The stones, having the designs drawn upon them in the manner described, are next treated with a mixture of dilute nitric acid and gum arabic. The acid attacks the portions of the stone not covered by the tracings of the design and dissolves its substance in a peculiar manner, the dissolved portions being replaced by the gum, so that the surface remains as smooth and uniform as before the acid is used.

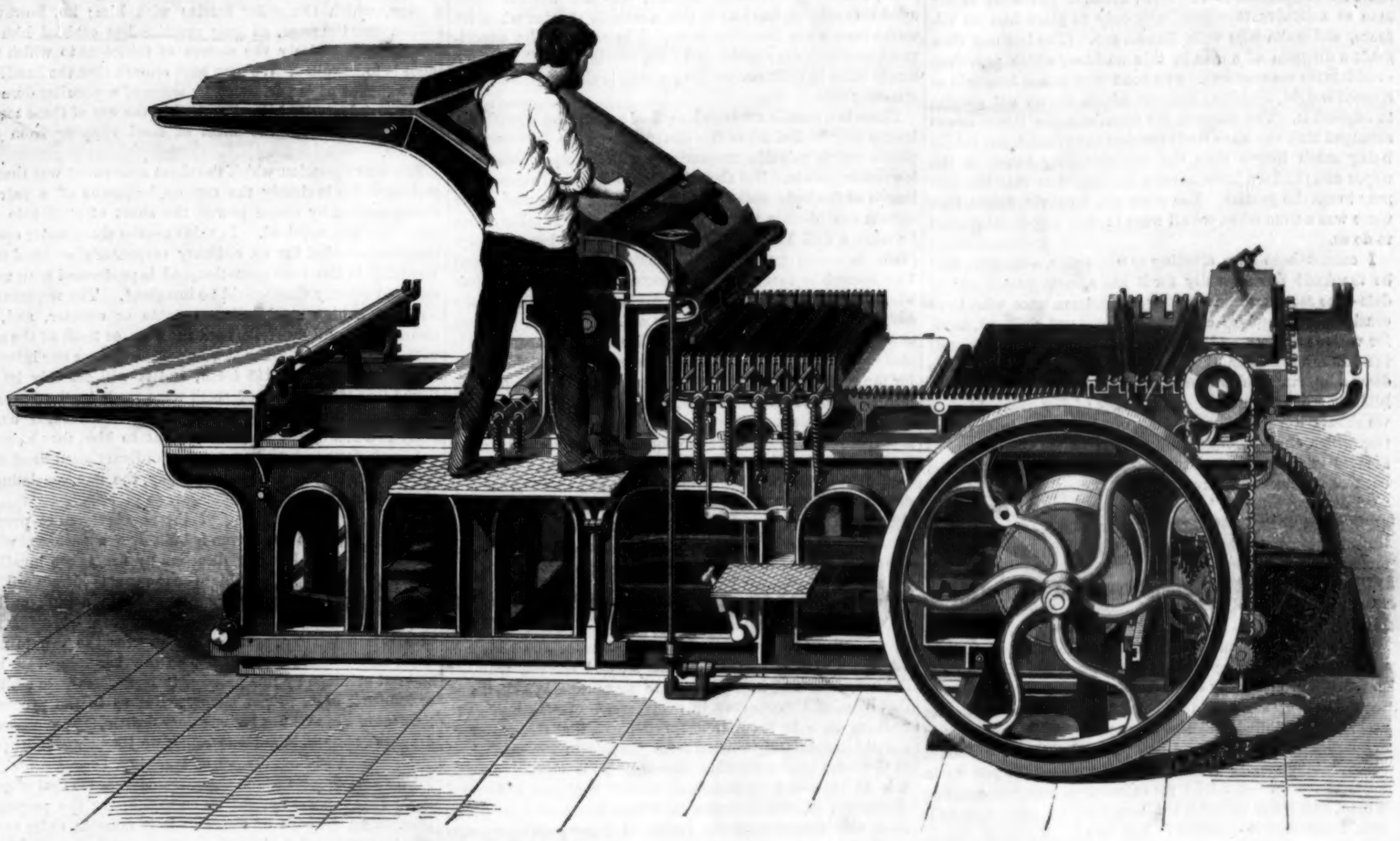
The block or plate is now ready to be used in printing. The kind of press exclusively used before the introduction of the cylinder press, was called the scraper press. This press is still employed, but is slow in operation, liable to break the plates, and has many other defects, which do not exist in the cylinder press.

The scraper press consists essentially of a roller, the bearings of which are connected with a toggle joint and lever, by which the roller may be pressed up with considerable force, and a scraper fixed directly over and parallel to the roller. The scraper is made of apple-tree wood with a blunt edge at the bottom faced with leather.

In printing, the stone plate, prepared as described below, is placed with one edge between the scraper and the roller, and the roller being forced upward, by the lever and toggle joint, raises the stone till it is brought into forcible contact with the scraper. The roller is then turned by a winch which carries the stone along until its entire surface has been passed under the scraper and back again to its former position.

The preparation of the stone previous to submitting it to pressure, consists, first, in moistening it with water. Those parts acted upon by the nitric acid and gum, absorb water readily, while the parts not acted upon, being greasy, do not take water. Immediately after moistening the stone, the ink is rolled in, the moistened parts not taking the ink, which only adheres to the greasy portions constituting the design. The paper is then laid upon the stone, and a tympanum of zinc or leather laid upon the paper. This tympanum is brought in contact with the scraper, and the pressure transmitted through it to the paper. The paper having thus received the impression of the design, is removed, and the process described repeated for each subsequent impression.

Now on the cylinder press every detail of this process is in its essential features performed automatically, except that the pressure is obtained by the weight of a heavy roller and powerful compound leverage connected therewith, which roller carries the paper and rolls over the surface of the stone in lieu of the roller, tympanum, and scraper, above described. The moistening of the stone, and the inking of the plate, are done by ingenious self-acting devices which perform the work in the most thorough manner, the dampening of the stone and the inking being done two or more times for each impression, as may be desired. Any kind of work is performed better than it can be done by the old means, and from twenty to thirty times faster. The press from which our engraving has been made will print blocks 60 by 40 inches, and as good lithographic stones of this size are difficult to obtain and handle, zinc is now much used as a substitute. The zinc is grained substantially in the same manner as the stones. The zinc plates are much cheaper, and may be obtained of any desired size.



HUGHES & KIMBER'S MONSTER CYLINDER LITHOGRAPHIC MACHINE.

The use of such plates—rendered possible by the large-sized cylinder presses—introduces the printing of life-sized pictures and portraits, and large posters, into the domain of the fine arts. Some of this kind of work now done at the establishment owning the press illustrated, is far superior to anything of the kind ever before produced in this country.

A peculiar advantage of the cylinder over the scraper, is, that the cylinder wears the stone much less than the scraper, so that from 20,000 to 30,000 impressions may be taken from a single transfer.

The press herewith illustrated is a model of strength, finish, and symmetry, and requires but little power. A great variety of sizes are manufactured, and a large number are in use in the principal cities of this country and Europe. The future of printing in this country will doubtless necessitate the combination of lithographic printing with type printing, as is already the case in Europe. The Hughes & Kimber lithographic press is admirably adapted to work in combination with the "Wharfedale," (illustrated in the SCIENTIFIC AMERICAN, June 25, 1870), by the same house; and it may furthermore be used for ordinary printing if desired.

The great advance made in the art education and instruction of the masses of late years, is perhaps due more to the advance in lithography, resulting from the introduction of these cylinder presses, than any other cause. Our readers will be gratified to see, and our engraving gives an accurate representation of, the press to which the public is greatly indebted for the general supply of cheap and good pictures.

HOW WE STAND AND WALK.

[Abstract of a Lecture Delivered before the American Institute by Prof. Burt G. Wilder.]

The second of the course of scientific lectures before the American Institute was delivered on the evening of Dec. 27, by Prof. Burt G. Wilder, of the Cornell University. The lecture was illustrated by diagrams and experiments.

After a somewhat humorous introduction the lecturer contrasted the walking of men with that of brutes. He said:

You will notice in menageries that the tallest apes are obliged to walk upon their feet as we should walk upon the hands, with the great toe standing out from the side of the foot, and the heel so short that it has not the power of supporting the body that our heel has. Here is a diagram of the skeleton of the foot of a man, and you see that the heel is long and strong; that the bones forming the arch of the foot are strongly put together. The great toe is the essential part of the foot in standing and in walking. If any of us have lost our great toes we should find immediately how difficult it is to balance ourselves upon our feet, because with man the use of the great toe lies in the propulsion of the body upon the feet, whereas in the gorilla the great toe stands out from the side of the foot like a thumb, and has no power whatever of supporting the body or propelling it like the man.

Du Chaillu tells wonderful stories of the grasping power of this hind hand of the ape, in which respect man's foot bears no comparison to it. Now, again, if you wish to see man at a disadvantage you have only to place him on all-fours, and make him walk like an ape. (The lecturer then made a diagram of a man in this position, which provoked considerable amusement). The head now hangs forwards as a great weight, requiring muscles which we do not possess to support it. The curve in the back, and the limbs are so arranged that the knee itself touches the ground, our thighs being much longer than the corresponding bones in the upper arm; and we have to raise the thighs so that the feet may touch the ground. You must not, however, forget that there was a time when we all went in this way or attempted to do so.

I cannot help here alluding to one thing, although, God be thanked! the necessity for it has almost passed out of date—the fact that some among the human race who have considered themselves even most refined and civilized, have, for various reasons and by various means, imitated some of the lower animals in their attitudes. If you were here to draw a human head and face with small jaws like this (exhibiting a head), and put on the back of it a great chignon, we should have simply the belle of the period in the position which she is obliged, by the very force of gravity, to assume in order to support this ponderous mass upon the back of her head. There is an old saying that "one good turn deserves another." I should change it in this case by saying that "one ill bend provokes another." In this Nineteenth century we have adopted what was originally the monkey bend, and not a Grecian or any other kind of bend.

There are several things to be said respecting the human foot, which is, of all the parts of the body, the least noticed. It is covered up, and not exposed at all times, like the hands. It has a degrading office, inasmuch as it is obliged to support the entire body upon it, and yet there are many things in the foot well worthy of our consideration. (Diagram of a foot, showing the way the bones are joined to form the arch, was exhibited, and the manner in which the body is supported was described). Now, in order that we should stand, it is necessary not merely that we shall be put up in an erect position—I might manufacture a pole representing a man, and set it upright, but how long do you suppose it would maintain its position? Not at all. It would topple over.

We do not realize the attention which is required of the mind to enable us to stand upright; yet there is a constant, although unconscious, attention of the brain, without which we could not maintain an erect attitude. And the muscles which lie along the legs, and which may be seen in the diagram, are in constant action. If you will stand on tiptoe, and let a person feel the muscles of the leg, they will be found in constant activity. There is a movement among them; some are falling backwards and some forwards, yet all are so adapted to each other that we are enabled to stand upright.

When we wish to lift ourselves upon tiptoe, then those muscles which are attached here (at the heel) contract with greater force. In ballet dancers and tight-rope walkers there is an immense development of the muscles of the calf, and indeed of the entire leg. The muscles attached to the end of the heel contract, the foot itself resting upon the ground, and form a lever of the second kind, as it is called, thus hoisting the body upon the toe; and the muscles which are required to keep the body on tiptoe are more than we dare enumerate almost.

Man's foot is called a plantigrade foot; that is, a foot which has the whole sole flat upon the earth. There is one other beast—and a very respectable one in his way, which has also a plantigrade foot, and that is the bear; but the bear's foot and method of using it differ from man's, and his method of using it, in this respect—that whereas as we walk we strike first the heel, and then roll forward upon the toe of each foot alternately, the bear lifts the whole of the foot together and puts it down flat, in precisely the same way that a negro clog dancer does. The bear has not the power to put down his heel first and then roll forward and give a spring as we do, but it puts it down flat, as any one of us would if we had a wooden leg. So that there is a difference both in the structure, and method of using, this useful member.

This brings us now to the subject of walking itself, which is properly the subject of the present lecture. I might take it up from half a dozen different points of view. After thinking the matter over I have concluded to approach it with reference, first, to a single familiar idea—the influence which walking, or which standing in different positions, has upon the hight of the body. There are three groups of facts which may be adduced in order to show that the hight of the body is affected to some extent during our walking and different modes of standing. One is the matter of common observation that we are shorter when standing upon one foot than when standing upon both.

[The lecturer's assistant at this point stood up beside a board, and his hight, standing first upon both feet and then upon one, was measured. Unfortunately for the theory, however, the man's altitude remained the same in both positions, a fact which brought smiles to the faces of the audience.] "I shall have to say, continued the Professor, "with a gentleman more distinguished than I can ever hope to be, who, when a certain experiment of his failed utterly, very coolly turned to his hearers and said: "Gentlemen, the experiment has failed, but the principle remains the same." [Laughter.]

The second matter in connection with this is stated by ladies—certainly good authorities in this day and generation —who say that the skirts of dresses which exactly clear the ground while the person is standing still, will, the instant they begin to walk, drag upon the earth; and in the third place, Dr. Oliver Wendell Holmes, who has written some upon this subject, has stated that a man is shorter when he walks than when standing erect. I have tried the experiment over and over again, and I am convinced that at every single point in ordinary walking a man is shorter than when standing still.

There is a certain average length of a man's body, and this length may be defined as the distance between two parallel planes which coincide respectively with his uppermost and lowermost points. But there is some difference between the length of the body and the hight. The length varies under certain conditions, and the first is that a man is taller when he takes a full breath than when he has his lungs empty. [This fact was practically demonstrated by the lecturer.] The second is that a man is shorter when he stands than when he is lying down flat upon his back. [The Professor's assistant laid down, and in that position measured five feet and eight inches; standing up, and carefully measured, it was shown that he was an inch shorter.] This difference is for the reason that when we are lying down, the whole body is allowed to stretch itself out, while in standing it settles down, so to speak. From the same cause comes the familiar fact that a man is taller in the morning than at night after he goes to bed. He loses, perhaps, an inch in the daytime. One other thing I will not stop to prove, and that is, that any deflection of the body from the perpendicular lessens the length of the body. We can prove that a man's body is shorter when it is bent. For instance, when we bend the body at the hips and spread the legs to any extent, or when we bend the knees, we become shorter. The hight of a body may be less, and yet its length be exactly the same.

In stating the phenomena of walking we have to consider two things—first, whether different parts of the body are bent upon each other when walking, and second, whether the body is swung from one side to the other. We shall find that both of these occur in every stage of walking. The walking man is peculiar in this respect, that the center of gravity is constantly shifted from one side to the other, and at the same time propelled forward. It is oscillated from side to side, and at the same time it performs a forward movement in the direction in which the person is going. Now this transfer of the center of gravity gives us that oscillation of the body which you see in very tall or stout persons when walking behind them. The leg of a giant is to the leg of a dwarf as is the pendulum of a large clock to that of a mantel clock. In the short man it swings more rapidly, in the tall man more slowly. The body is carried forward steadily, but the legs are not.

The lecturer then exhibited a gradigraph, a simple apparatus consisting of two hollow tin tubes placed so as to form a right-angle triangle, each tube containing a wooden piston resting on a spring, and having attached to the outer end a piece of charcoal. By means of this instrument he showed the variation in hight of a person while walking, and also the oscillation of the body from side to side. "I do not," said he, "claim for this instrument any wonderful powers, but it is, I think, possible by this means to get a more exact idea of the gaits of different nations. It would certainly be easy to recognize a gait having any distinct characteristics, as, for instance, a stage stride. We know that the French walk different from the Prussian, and the Prussian from the English. It is possible that this instrument may yet be perfected so as to measure the exact amount of oscillation upward and downward and from side to side. One very curious fact in regard to walking is that one side of the body always tends to outwalk the other side. It is not possible, when the eyes are shut, to walk in a straight line for any length of time. We have heard stories of persons losing their way in woods and on prairies, and coming out so as to indicate that they had been walking nearly in a circle. I have myself tried experiments in a large room, and have found on looking at a crack in the floor and closing the eyes, that it was impossible to keep that crack. I almost always turned to the right; and it will be found, where persons lose their way, that they almost invariably wander off to the right rather than the left.

IT it estimated that there are at present in this city out of employment, 1,000 bricklayers and masons, 400 stair-builders, and 800 painters.

MANUFACTURE OF SAWS IN SHEFFIELD.

[Condensed from The Ironmonger.]

We were first taken into the rolling mill, in order to witness the manufacturing process from its beginning, and we must confess we were at first rather startled by the sight which met our unaccustomed eyes, and by the sounds with which our ears were greeted. From every side, while red-hot metal was being thrown about in every direction, sounded the loud whirring of rolls, creaking of engines, snicking of shears, rumbling of wheels, and roaring of furnaces. Men stripped to their shirts, with perspiration starting from every pore, were busily employed in rolling ingots of steel, which are cast on the premises into sheets, bars, rods, etc.; but we at present have only to do with the sheets. Accordingly our conductor led us to a furnace of moderate dimensions, from which the furnace man took a red or rather white-hot ingot. We may here remark, that the ingots which are used for sheet rolling are of different shapes and dimensions, according to the size and description of saw they are intended to produce. The ingot having been taken from the furnace, is handed to the roller (we mean the man, not the rolling apparatus), who passes it between the rolls, it being received on the opposite side by another workman called the backer, and being by him repassed to the roller. After passing and repassing between the rolls several times, the ingot is transformed into a sheet of steel, the degree of thickness being determined by a gage, which the roller carries with him; he, however, seldom uses the gage, as long practice has enabled him to determine to a nicety the degree of thickness to which the ingot is to be rolled. We may here remark that the handling above spoken of is performed by tongs of a peculiar description, great dexterity being required in the use of these tongs, in order to prevent the sheet of steel slipping from the nippers.

The next operation which the sheet underwent was that of paring, which is simply the cutting, by means of a pair of shears worked by steam power, the sheet of steel into the shape and size required. In this case the sheet under operation was intended for an ordinary carpenter's or hand-saw. Toothing is the next operation, and is performed with more ease and celerity than would be imagined. The workman is seated on a high stool before a table or counter, and, by means of a small fly, strikes out the cogs, or teeth of the saw, with great rapidity. The saw he acted upon for our information contained about 115 teeth, and it will scarcely be believed that this number of teeth were made in the space of less than two minutes. The tooth-cutter informed us, in reply to a few questions which we put to him, that he could cut as many as twenty-four dozen of ordinary-sized hand-saws (say twenty-four inches long) in a day, the day consisting of about eight hours.

Hardening and tempering of the saw is the next process. For this purpose a large oven is built over a furnace, which being surrounded in every direction by fire, is continually in a state of red heat. Into this oven the saw is introduced, and when red hot is taken out and plunged into a tank or bath containing oil. After remaining in this bath for a few minutes, it is taken out, and by this process the saw is made hard, or, we would say, stiff. The saw becoming very bent, and out of shape by this process, it is necessary to smith it, or reduce it to its proper shape. But as in the process of hardening the saw has become very brittle, it is necessary to draw the temper, in order to allow of its being smithed or straightened without danger of breaking.

The next process which the saw undergoes is that of grinding. This is not, as might be supposed, for the purpose of sharpening the edge of the saw; it is done in order to take off the rough and dull looking surface, and give it a bright and highly polished appearance.

The grinding room is simply the shed or building within which the grindstones are placed. The grinding is performed by a grinder standing or sitting upon a horse (the block of wood placed at the back of the grindstones, upon which the workman stands or sits) and pressing the saw with all his weight and strength upon the grindstone. We must confess that we were agreeably surprised by the appearance of the saw-grinders, they being, we thought, remarkably mild and inoffensive-looking men, and exhibiting none of those signs of brutal ferocity which we had almost expected to find among the associates of the notorious Broadhead and Crookes, of saw grinders' trade-union celebrity. We noticed one thing with reference to the vocation of the saw grinders, which was that their work must, to say the least of it, be very disagreeable in cold weather, owing to the continuous stream of water that is pouring over their hands, our readers being, no doubt, aware that cold water is always flowing over the grindstones in order to neutralize the friction proceeding from the contact of the steel with the stone. The grinders, we are sorry to say, labor under the disadvantage of great danger in their work—apart from the danger which is always threatening them—and which cannot always be effectually guarded against, of the grindstones flying or breaking, thereby perhaps killing or seriously injuring all or a great number of the men in the grinding room, the men knowing that they are inhaling poison, and consequently death, with every breath they take, the particles of steel and of stone entering into their lungs, and sending them off the face of the earth, at, in many cases, a premature age. This being the case with the wet grinders, how then must it be with the dry grinders, who have not the advantage which the others enjoy of having many of the deadly particles taken off by the water? Besides this, in the case of the wet grinders the stone rotates *from* the workman, in the case of the dry grinders, the stone rotates in the opposite direction, that is to say *full in their faces*. We left the grinding wheel with feel-

ings saddened by the reflection that the fine-looking young men we had just seen employed, in full vigor of their youth and strength, were dying by inches.

The glazing or polishing room was the department next visited, and our saw was handed to a workman, who immediately proceeded to glaze and polish it. This he did by passing the saw over a wheel, in the same manner as the grinder had done. The wheel is made of very hard wood, and is placed in front of a stand or horse, upon which the operator stands with his feet resting upon a description of stirrup, the workman being, in fact, in the same position as the wet grinder. The wooden wheel being painted with a glutinous substance, is covered with emery.

The saw is next taken to the finishing room. Here at a long table sat two or three females at work varnishing the saw handles, while at different benches men were cutting the handles out of planks of wood. We may as well remark here that the handles are made of several kinds of wood, common saws bearing beech-wood handles, and the best saws generally having handles made of ebony or mahogany. The saw-handle maker taking a plank of beech wood, marked with a pencil six or eight handles upon the wood, he next with a small saw divided the wood into as many blocks, and gradually, and with great care, cut these blocks, by aid of the small saw, into the shape of saw handles; he then with a file, filed every portion of the handle down to smoothness, and passing it over to a woman who sat at the varnish table, she covered it by means of a small brush with varnish. The handle being then placed on a rack with a number of others, was left to get dry.

Sewage Purification.

During the past twelve months a series of experiments has been carried on at the Ealing Sewage Works to test the system there adopted for the purification of the sewage of Ealing. These experiments have been carried out by Mr. Jones, the local surveyor, under the superintendence of Professor Way, who, after paying more than thirty visits, has drawn up a most favorable report, which was published by the Local Board authorities on Saturday last. The sewage of Ealing is dealt with by means of filter beds, of which the Professor thus speaks: "These filter beds are, in my opinion, of very great importance in carrying out any process of purification of the sewage previous to its discharge into the Thames. Without them it would be impossible, by the best precipitants known, to clarify the sewage in the tank, for no matter how perfect the system of precipitation may be, there is always some portion of flocculent matter which will not settle, and which can only be removed by filtration. These filter beds are an excellent feature of the Ealing Sewage Works." Speaking of the use of chemicals to precipitate the sewage, the Professor says: "Several years since I expressed the opinion that if to the system of filtration that of previous precipitation were added, the Ealing works would be among the most perfect, if not the most perfect, of their kind in the country. I have seen nothing recently to alter that opinion. The precipitants employed are lime and a cheap salt of iron, the latter made on the premises by a process suggested by myself. With the lime is used a preparation of tar, but the chief effect in the clarification of the sewage is undeniably due to the lime and the iron salt. Slaked lime is mixed with water and the tar compound, the lime is kept in suspension in the water by air pumped into it by a small steam engine, which is also used to pump water. The lime and tar compound are added to the sewage as it enters the works. It then passes to the tanks where the greater part of the suspended matter is deposited. At the last of the sub-division of the tanks, a solution of iron salt is allowed to flow into the sewage water, and advantage is taken of a slight fall to move a small water-wheel, which assists in the mixture of the iron salt with the water. The water then passes by upward filtration through two filter beds. It is not for a moment asserted that the effluent water at the Ealing works is pure, and the only question is whether it is rendered so far free from offensive matter as to allow of its discharge into the Thames. Since July, 1869, I have visited the works more than thirty times—two thirds of such visits being during the past hot and dry summer. The state of the water has necessarily varied with the more or less complete success of the treatment employed during the experiments; but since the system has been in good working order I have considered the result to be very satisfactory. The effluent water, though not absolutely bright, has only a faint milkiness, which a more liberal use of chemicals would entirely remove. It is free from smell, and samples that have been kept for weeks have only in rare instances become offensive. I have no doubt a moderate amount of attention will insure a uniformly good result."

The Effects of the Franco-Prussian War on Industry in the North German States.

On entering Germany in August last the most unobservant of travelers could hardly fail to be impressed with the fact that war, for the time being, had become the first and almost sole business of the nation, or, more properly, of the Confederate Germanic States. In Rhenish and Northeastern Prussia production seemed to have been in a great degree arrested; few civilians were to be encountered, either upon the cars or at the hotels; while the transportation of merchandise by rail or boat, except for military purposes, was also apparently entirely suspended. Private letters written as late as the middle of October describe also the same condition of affairs, and make mention of the difficulty of even finding a blacksmith to shoe a horse in many of the German villages; with the further incident that even the sextons had left their churches and gone to the actual war districts in the capacity of *Krankenstager*, or hospital attendants, whose special duty is taking care of the dead.

The opinion of German authorities, more competent to judge than a transient observer, and since communicated to the writer, has been, however, to the effect that production is not really interrupted by reason of the war in Germany, as a whole, to a greater extent than 30 per cent; the interruption being greatest in Prussia proper, where the military conscription has been the most extensive, and least in the allied States, as Saxony and Bavaria, where a smaller proportion of the young, able-bodied men are drawn into the army; and in the German States and "free cities" which, like Nassau and Frankfort, have been incorporated with Prussia since 1866, and where the Prussian military laws have only been made applicable to those who have become of age since the date of incorporation.

The general effect of the interruption of industry in Germany by reason of the war may be inferred from the earnest appeals that have recently been made to the charity of all Germans in behalf of the working population of Rhenish Prussia, Hanover, Baden, and Hesse especially. One of these appeals brought to our notice, under date of September 28th, uses the following language:

"The towns in these districts are crowded with helpless women and children, coming in to beg for bread; the fields are left untilled; the villages are swept clean of food; while the price of all the necessaries of life have gone up threefold."

At a period as early as the last week in August the appearance in every German city, town, or hamlet of considerable numbers of men in uniform hobbling upon crutches, or with their arms or heads bandanged, testified most eloquently to the terrible results of the recent battles; while at the railway stations, or in the vicinity of the rooms or buildings appropriated for use as hospitals, the spectacle of women clad in mourning or weeping bitterly was not by any means unfrequent. There is also reason to believe, owing to the practice of grouping the local or district conscriptions into companies, battalions, or regiments, by themselves, that the almost entire destruction in some instances of such military integrals has been equivalent to the destruction of almost all the young, able-bodied men of certain small towns and villages. And as regards the comparative losses of the two armies, the opinion expressed to the writer by numbers of Prussian officers who were wounded in the battles before Metz were almost uniformly to the effect that the losses of the Prussians were greater than those of the French, inasmuch as the former were nearly always the attacking party, while their opponents, until routed, fought under cover or behind buildings, hedges, or intrenchments.—*David A. Wells in Lippincott's Magazine.*

Zinc as a Roofing Material.

Hitherto our most available metallic roofing has in this country been tinned iron plate—an article imported almost entirely from Europe. In view of our extensive deposits of zinc, the subject of zinc as a roofing material is an important one, and hence the following notes, which we take from the London *Builder*, have a peculiar value:

"The use of zinc has rapidly increased in this country within the memory of the present generation. In 1845 the annual consumption was about 5,000 tuns, which had increased in 1860 to 25,000 tuns, or five-fold. Since then the progress has been still more rapid, and the returns of one company alone recently showed the figure of £45,000 as the gross of their annual transactions in zinc, used solely for roofing in England and the colonies; and future years will probably show a still greater increase if the arrangements now made to secure 'good work' be carefully carried out.

"We should premise that throughout the continent its use has been, and still is, more extensive. In Paris it is the leading material for roofs of every description. We may mention as examples the newer portion of the Tuilleries, all the new markets, nearly all the mansions of the new Boulevards, and the Champs Elysees, dating as far back as 1830. Other places throughout Europe may be quoted to any extent, but we think the above quite sufficient to prove that the material has established itself as adapted for works of good character.

"The more extended use of zinc, for roofs in this country, to which we at first alluded, dates from the year 1859, when the Vielle Montagne Company, the largest manufactory of zinc in the world, instituted a special inquiry into the causes of the failure of zinc here, which was conducted by Mr. James Edmeston; and the result was to show clearly that the faults did not arise from the nature of the material itself, but from the use of inferior quality in some instances, and improper workmanship in others. In all cases where the zinc was good and the work properly done, it has stood the test of time, requiring neither painting nor repairs, and when of proper thickness it forms one of the most lasting materials for roofing that can be employed.

"We may here point out the causes of failure which are to be avoided.

"The first is the quality of the metal, which, when manufactured from inferior ore, contains certain other metals in admixture with the zinc, which, when exposed to atmospheric influences, set up voltaic action, leading ultimately to the destruction of the metal; this kind of zinc is spotty and uneven in color, and darker than the proper quality manufactured from the best ore, the calamine.

"The second cause of failure is defective workmanship, using the zinc too thin, not allowing sufficient play for expansion and contraction, using iron nails, or allowing the zinc to come in contact with iron or lime; in either case a destructive chemical action being the result.

"As examples of work done in this country, we may notice the cloisters of Canterbury Cathedral covered twenty-four years ago, and which have not cost £5 for repairs; the Victoria Station, ten years ago, now in a perfectly satisfactory state; as well as many stations on different railways, and many other buildings in England.

"In conclusion, we may notice the peculiar way in which the atmosphere acts upon zinc. Quoting from a report made to the Academy of Sciences by the Director of the Conservatore des Arts et Metiers:

"'It appears from actual experiment that the oxidation proceeds for about four years, gradually diminishing after the first three months, and that it then hardens into a protecting coat, *email*, of a dark-gray color, preserving the metal beneath from any further deterioration.

"'It becomes evident that as a sheet of zinc exposed to the atmosphere for a series of years loses little or nothing of its weight or thickness, and as its surface remains hard and polished like enamel, it may fairly be deduced that the following years are not likely to occasion any alteration, and therefore zinc will be in the same condition as bronze, which is protected by its *pattine* for ages.'

"There has been, to some extent, a prejudice against zinc as a lasting material, but with the evidence before us, we may safely say that where it is of a proper description and well laid, this is utterly unfounded. Its lightness and cheapness will doubtless render its use more extensive, if only necessary precautions be taken."

Poker Pictures.

The curious productions known as poker pictures, or poker drawings, have neither paint nor inlay, neither pressing nor cutting. They are nothing but panels of wood in which dark shadings have been produced by the application of red-hot tools. Many school rooms, many country mansions, and some churches, are in possession of specimens of this kind of art. A Study of a Female head, a Tiger killing a Deer, the Temptation of Christ, Cornelius sending for St. Peter, the Savior bearing the Cross, the Good Samaritan, the Head of a Rabbi, Oliver Cromwell—these are among the subjects of such pictures known to have been produced in this eccentric department of art. Connoisseurs of poker pictures talk about Smith of Skipton, Cranch of Axminster, Thompson of Wilts, and Collis of Ireland, as artists of some note. About the beginning of the present century, there was an exhibition of poker pictures in London, comprising fifty-three specimens by a Mrs. Nelson, and thirteen by Miss Nelson. The pictures were, without any high-flown words, described as having been "done on wood with hot pokers." The scorching is effected by any heated bar of iron; but in the best specimens tools of various shapes are used, to make some of the scorched lines narrower and finer than others; the artist having, literally, many irons in the fire at once. The actual lines of the device are first penciled or drawn; the scorching is to produce the shadows, the lighter tints being the result of holding the red-hot iron very close to the wood, but not quite touching. If the panel has any strongly marked lines, fibers, knots, eyes, curls, or other diversities of grain, the artist sometimes avails himself of these to produce pictorial effect, scorching around or near them, according to circumstances. In one instance a knot in the wood was made to represent the eye in a portrait, by a few judicious touches of the scorching-iron; while in another case curled lines or grain-marks were made available to represent the furrows in an old man's cheek.

How to Make Hens Lay.

People would better understand this matter, says the *Country Gentleman*, if they considered for a moment a hen to be, as she is, a small steam engine, with an egg-laying attachment, and thus there must be a constant supply of good feed and pure water to keep the engine and its attachment up to its work. In addition to keeping before hens, who have complete liberty, a constant supply of pure water, summer and winter, I have found that during the cool and cold weather of fall, winter, and spring, a dough compounded as follows, fed one day and then intermitted for two days, to produce excellent results: To three gallons of boiling water add one half an ounce of common salt, a teaspoonful of cayenne pepper, and four ounces of lard. Stir the mixture until the pepper has imparted considerable of its strength to the water. Meantime the salt will have been dissolved and the lard melted. Then, while yet boiling hot, stir in a meal made of oats and corn, ground together in equal proportions, until a stiff mush is formed. Set away to cool down to a milk warmth. Before feeding taste to see that you have an overdose neither of salt nor pepper, and to prevent the hens being imposed upon with a mixture not fit to be eaten. The hen mush should not be more salt than to suit your own taste, nor so hot with pepper that you could not swallow it, were so much in your broth. Beware of too much salt, too much lard, and too much pepper; and beware, too, where the seasoning is not too high, of feeding this dough too long at a time. Let the hens be fed one day fully with it, then let it be omitted and the ordinary feed given two days, and so on, and the result will be found satisfactory. *Take notice*—hens fed this way will be a good deal less inclined to set than when fed in the ordinary manner.

THE new method of supplying water to the Continental Hotel, in Philadelphia, by means of the artesian well, has, after a trial of seven weeks, proved satisfactory. The well is two hundred feet deep, one hundred and fifty-five of which were bored through solid rock. The bore is eight inches in diameter. Fifty thousand gallons of water can be obtained for use every day. The cost for the work was three thousand dollars. The water obtained is softer, purer, and much healthier, for both cooking and drinking purposes. The uniform temperature is fifty-five degrees.

Improvements in Brick Machines and Brick Molds.

We illustrate in connection with the present article a brick machine and a brick mold, by the employment of which, it is claimed, considerable saving may be made upon the cost of making bricks in the ordinary pugmill and molding press, as the pressing is done automatically by a device connected with the mud-mill shaft, which shaft is propelled by the usual horse-power, or by other power, as may be convenient.

Fig. 1 is a perspective view of the machine; Fig. 2 a sectional elevation, and Figs. 3, 4, and 5, details showing the construction of the mold.

A is a weighted lever, pivoted at B to the side of the mud-mill, and connected to the stock, C, of the follower, D, Fig. 2, by a crank bolt or other device which will admit of the lever and follower rising and falling together. The lever, A, is connected by a rod, E, with the arm, F, of a crank shaft, mounted on the top of the mill, and having another crank arm, which is raised by the action of the cam, G, also raising the arm, F, and the weighted lever, A, and the follower, D, at the time the arms on the lower end of the mud-mill shaft are in position to fill the mold box, and allowing the whole arrangement to fall at the proper time for pressing the bricks in the mold. This simple movement automatically effects the pressing of the bricks.

The mold-box carriage, H, is mounted on a single strong beam, I, having slides, J, made of bent iron bars, attached to the under side and fitted in grooved supports, K, made vertically adjustable for regulating the carriage relatively to the bottom of the mold.

The carriage is moved back and forth by the oscillating shaft, L, and hand lever, M, in the ordinary way. N is a short lever pivoted to the front end of the carriage so that the short end will project upward in advance of the brick mold, and the longer arm hangs down so as to be arrested by a stop just before the termination of the inward movement of the carriage, whereby the short end will be forced against the mold box and clamped firmly against the plate, O, or other part of the mill to hold it while filling

Fig. 1

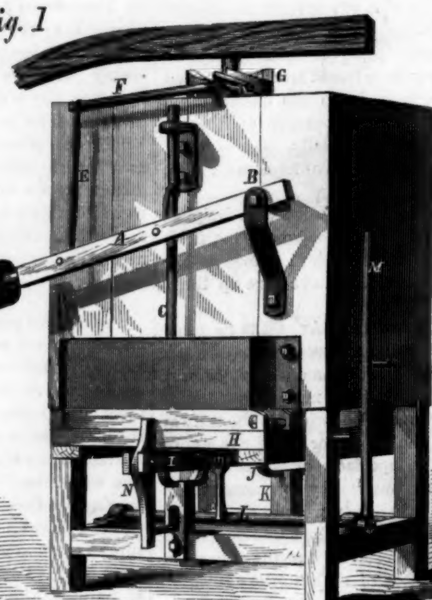
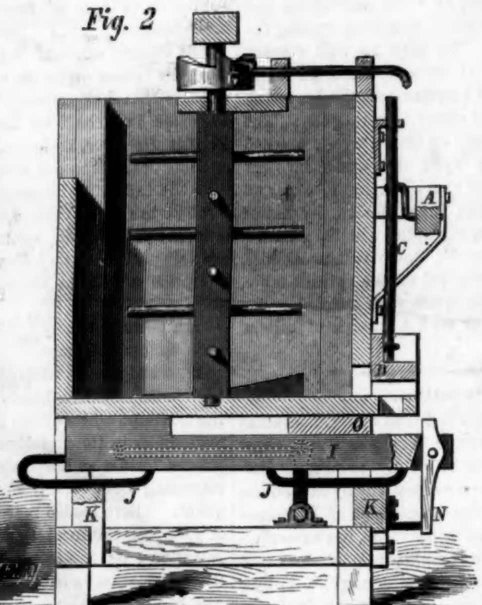


Fig. 2



TAYLOR'S BRICK MACHINE.

Fig. 3

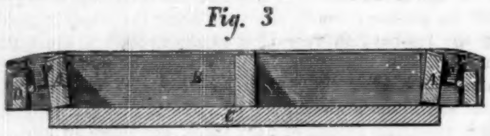


Fig. 4

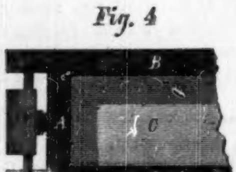
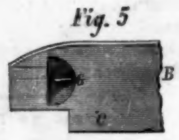


Fig. 5



The forward movement of the carriage releases the lever from the stop, so that the mold box may be drawn off the front over the short end of the lever, which will be turned down by the box.

Fig. 4 is a plan view of a portion of the mold box; Fig. 3 is a longitudinal section of the same, and Fig. 5 a partial side elevation.

The end pieces, A, of the mold are pivoted to the side pieces, B, near the bottom, C, or to the bottom itself, so as to swing outward, to release the pressed bricks when the mold is turned bottom up for discharging them, and the side pieces are also capable of swinging outward. For closing the ends and sides and holding them closed, pawls, D, are employed, pivoted near the edge and next the ends, A, of the mold, so that when the mold is right side up and held in the hands by the outside edges of the handles, the latter will turn on the pivots and cause the metal tappets, E, Fig. 3, placed on the inner edges, to bear against the plates, F, on the ends, A, and thus close the ends; and the crank arms, G, Fig. 4, will be forced down on inclines formed on the side pieces, thus forcing them together.

By this arrangement also the handles will be turned to release the ends, A, and sides, when the molds are turned bottom up and held so that at the time it is required to discharge the bricks they will be released from the friction on the ends and sides and escape more easily than if the ends and sides are immovable.

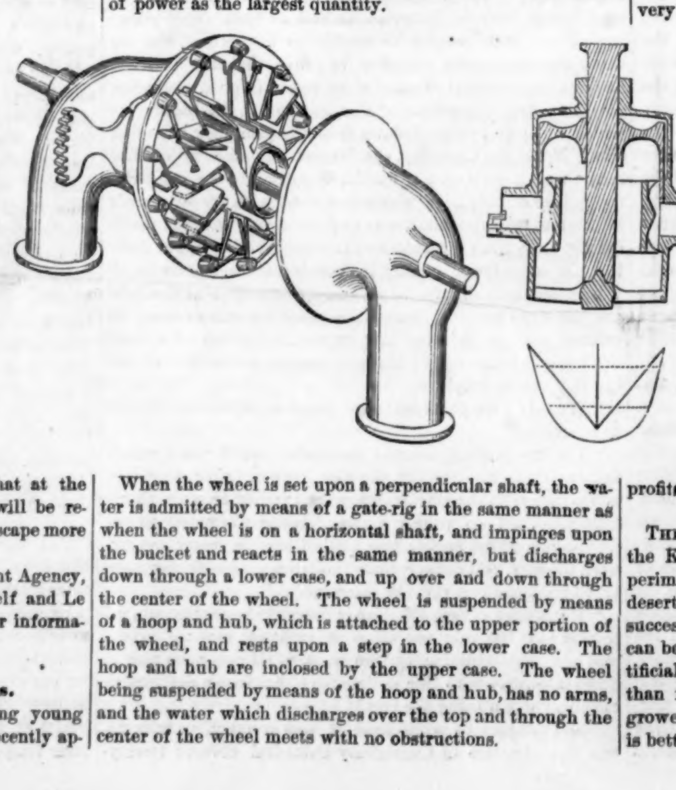
Patented, through the Scientific American Patent Agency, Nov. 29, 1870, by S. H. Taylor, assignor to himself and Le Grand Parker, either of whom address for further information, at Jacksonville, Ill.

Rope Coffee and Spring-saw Beans.

A city paper says that Minnie Lee, a nice-looking young woman, residing at No. 128 West Tenth street recently applied for admission to the Tombs prison in order to visit James Thompson, a notorious and desperate burglar, now awaiting trial at the General Sessions. She had a dinner pail in her hand, containing coffee, and a large dish containing baked beans, which she pretended to have brought for the prisoner. The woman acted in a nervous manner, and so attracted the attention of the keeper, and he proceeded to examine the pail, finding it made with a false bottom, which was filled by a coil of rope fully thirty feet long, and neatly covered by hot coffee. Minnie was at once arrested, and the cell occupied closely examined, the search being rewarded by the discovery of two old knife blades, a patent jointed steel jimmy, and a couple of roughly-made spring saws, intended to sever iron bars. When the prisoner was arraigned before Justice Dowling, at the Tombs Police Court, she was fully committed for trial, in default of $1,000 bail. After Minnie was removed to a cell the plate of beans was examined and found to contain a handsomely-made spring saw handle, a small steel wedge, and ten or twelve beautiful watch-spring saws. With all of these tools, had he obtained possession of them, Thompson would have found no difficulty in escaping from his cell, and probably from the prison, during the night.

IMPROVEMENT IN WATER WHEELS.

Our engraving shows an improved water wheel, invented by John C. Trullinger, of Oswego, Oregon, and patented by him, Feb. 11, 1868. The wheel is to be used both as a perpendicular and horizontal wheel. The wheel upon a horizontal shaft in the cases is set on the floor of the penstock, and the apertures cut in the floor for the escape of the water from the cases. The water is admitted to the buckets of the wheel through apertures of stationary guides, by gates, which are moved and adjusted by means of a series of levers, attached to the base of a movable ring. The direction given to the water by the guides causes it to impinge against the fore part of the buckets at the greatest diameter of the wheel; and, by means of the peculiar curve of the buckets in discharging, reacts upon the outer edge of the buckets and greatest diameter of the wheel, so that, it is claimed, the smallest quantity of water is used with as great a percentage of power as the largest quantity.



When the wheel is set upon a perpendicular shaft, the water is admitted by means of a gate-rig in the same manner as when the wheel is on a horizontal shaft, and impinges upon the bucket and reacts in the same manner, but discharges down through a lower case, and up over and down through the center of the wheel. The wheel is suspended by means of a hoop and hub, which is attached to the upper portion of the wheel, and rests upon a step in the lower case. The hoop and hub are inclosed by the upper case. The wheel being suspended by means of the hoop and hub, has no arms, and the water which discharges over the top and through the center of the wheel meets with no obstructions.

The German North Polar Expedition.

In a letter from Gotha, dated the 1st of October, Dr. Petermann thus sums up the results of the expedition:

"The results and successes of the second German North Polar expedition are manifold in character, and relate to various branches of science; they prove the approachability of East Greenland in high latitudes; a comparative fullness of animal and vegetable life in the interior of the land, the existence of beds of brown coal, navigable fjordes, going deep into the country, immense mountains, as high as fourteen thousand feet, and for these latitudes a not unfavorable temperature.

"As the principal results may be assumed, that with this expedition a new path to the final exploration of the North Polar regions is opened, new ground trodden, a new direction taken, and a new basis won. From the lands lying nearest to East Greenland, for example, the west coast of Spitzbergen and Greenland, scientific circles had long possessed large natural scientific collections of every description, which have given of late years important insight, especially in regard to the geology and history of our earth; it is easy at any time to bring whole ship-loads of collections relating to these departments to Europe; but it was not so with East Greenland, this extended *vis-à-vis* of our quarter of the globe. Of this hitherto almost unknown, scientifically, great district, every exploration, every collection—every single petrification for example—is of especial value toward filling up the knowledge of our earth; Ober-Lieutenant Payer gathered on his various land excursions in East Greenland not less than twenty boxes of geological specimens, among them being many petrifications. With his theodolite he ascended up as high as seven thousand feet, accompanied by Dr. Copeland and Peter Ellinger. No other land possesses such magnificent characteristics, navigable fjordes, with a high temperature of water and air, immense mountains rising to a hight of fourteen thousand feet, great herds of musk-oxen and reindeer, etc., as Greenland.

"That a German expedition of discovery, fitted out from voluntary contributions from prince and people, has here opened up the way to the Pole, will bring imperishable fame to Germany. For more than five years great exertions have been made in England, France, and America to set afoot a scientific expedition for the exploration of the Central Arctic regions. Germany, however, has gone first into actual duty, and has achieved already great results."

Sewing Machines.

The number of these machines made by twelve principal companies during the past year amounted to 320,669, which, at the average price of a first class machine, say $75, aggregated total, $24,050,170. The first class American sewing machine is to be found in all quarters of the world, and the supply comes principally from this city and Boston. There are many cheap machines which are sold all the way from two to twenty dollars, which are not counted in these figures; also many cheap imitations of the best American machines manufactured in England and on the Continent which are sold as of American make. Germany, in particular, does a very large business of this kind, Hamburg having no less than six large factories running, and finding a market principally in Russia, with which country we have comparatively little direct trade. Notwithstanding this competition, the machines sent from this country command high prices abroad, on account of excellence in workmanship and finish, and are exported in large numbers annually. All of the largest manufacturers have agencies in the principal cities of Europe, and receive large orders from abroad by nearly every steamer. The largest number made by any one concern in a year was 86,781. Notwithstanding the large amount of work which can be done by these ingenious contrivances, which used to be done entirely by hand, there seems to be no diminution of hand work in many branches of business. As the cost of manufacturing good machines varies from $12·50 to $60, and the prices at which they are sold range from $60 to $350, the profits of the business are enormous.

THE AMERICAN DESERT.—R. S. Elliott, Industrial Agent of the Kansas and Pacific Railroad, reports upon extensive experiments to cultivate the soil of the great plain, or American desert, along that road. Irrigation was dispensed with, and success is claimed, the result being thus summarized: Forests can be established in all parts of the plains, even without artificial irrigation. Much deeper plowing will be required than for winter grains or forage plants. The most rapid growers are the best trees for first planting. Planting seeds is better than to transplant young trees.

PERPETUAL MOTION.

NUMBER VI.

In 1865, Herman Leonhardt, of St. Gall, Switzerland, invented a new motive-power engine, which he thus describes: "I avail myself of the property of bodies or objects of a certain specific gravity when immersed in a fluid of a greater specific gravity to rise or ascend to the surface of such fluid. This buoyancy represents a greater or lesser force or power according to the greater or lesser difference between the specific gravity of the object and that of the fluid, and the size of or the displacement caused in the fluid by such object. In order to make the said objects, which I will call floats (see Fig. 13), as light as possible, and yet strong enough to resist the pressure of the water, I construct them of thin sheet metal, and in preference, in the form of tubes or hollow cylinders with flat ends. A number or series of these cylinders placed horizontally parallel to each other, are hinged or linked together in a similar manner as the buckets of a chain pump; this chain of floats is passed over two sets of pulleys or disks fixed to two horizontal shafts, the one placed vertically above the other, the said pulleys being formed to suit the diameter of the floats. One half of this chain of floats passes through the center of the tank holding the water or other fluid, and the other half passes outside the tank through the air. The floats, when in motion, enter through the bottom of the tank, in the manner hereafter described, and rise up by their buoyancy through the water; they then pass round the top pulley, descend outside the tank, and passing over the bottom pulley, again enter the tank, and so on. If cylindrical floats are used, as described. they are fixed on the connecting links half a diameter or more apart from each other; therefore supposing the floats to be fifty centimeters in diameter they would be placed twenty-five centimeters apart.

"Now the principal part of my invention consists in relieving the floats, when entering through the bottom of the tank, of the pressure of the water column, which pressure, if not removed or neutralized, would render the rising of the floats in the water impossible, and prevent the machine from acting. The manner in which the floats are relieved from the pressure of the water column when entering the tank is as follows: On the bottom of the tank I form an entrance chamber for the said floats of a depth equal to the diameter of a float; the bottom of the chamber and its top are each provided with double slides which open and close as the floats enter and leave the chamber. Supposing the floats to be in motion, and one of them to have arrived in the center of the chamber, a lever actuated by the moving floats or by the revolving float pulley or disk, will cause the top or egress slides of the chamber to open in the same measure as the float rises; this slide, acting through another lever, will, at the same time, open a slide or valve in the side of the chamber and admit water into it, thereby bringing the water in the tank and in the chamber into equilibrium. When one half of the float has passed through the top or egress slide, the next float will have arrived at the bottom or ingress slide, which latter will now open in proportion to the rise of the float. The egress slide will close in the same measure and at the same time shut off the communication between the tank and the chamber, which was necessary for establishing the equilibrium. At this juncture other valves connecting the chamber with pipes leading to the top of the tank are opened, and the water in the chamber, which would be detrimental to the further rise of the entering float is withdrawn through these pipes, which I will call return pipes, by suction, and allowed to flow back into the tank above the water level; this suction is effected through the following arrangement:—That portion of the top of the tank where the floats leave the water is open, but the other portion of it is covered, and a partition dividing it from the open portion is made to dip into the water to some depth, thereby rendering it a hermetically closed chamber, and the above-mentioned return pipes open at a certain hight above the water-line into it. This chamber I call the vacuum chamber, because previous to starting the machine a vacuum or a partial vacuum must be formed in it, and afterwards maintained as long as the machine is to continue in operation. The air is exhausted from the chamber by means of an air pump driven by the machine, but arranged for driving by hand for the purpose of starting the machine. By forming this vacuum the original water level in the tank will be disturbed, the water level being raised in the vacuum chamber and lowered to a corresponding extent in the open part of the tank. Supposing the tank to be of a hight to hold six floats 1, 2, 3, 4, 5, and 6, 1 being the one above described, as entering the admission chamber, it is clear that as 6 leaves the water, the water level in the open part of the tank will be lowered in proportion to the displacement previously caused by 6, and the water level in the vacuum chamber being thereby likewise lowered, it will cause a suction or drawing up of water in the return pipes, equal in quantity to the amount of water displaced in the entrance chamber by the entering float, 1. The water sucked up through the return pipes will flow over into the vacuum chamber and distribute itself in the water of the tank. The ingress and egress slides of the entrance chamber are furnished with linings or packing of felt previously boiled in oil for insuring a water-tight fit against the floats without much friction, and the flat ends of the floats likewise pass between sheets of felt previously boiled in oil and pressed against the flat ends by fluted rollers. The air pump is maintained in operation in order to remove the trifling quantity of atmospheric air adhering to and introduced into the tank by the entering floats. The motion communicated by the rising floats to the float pulleys or disks and shafts, is further transmitted by means of belts or other gearing, in the manner usual with other motive-power engines.

FIG. 13.

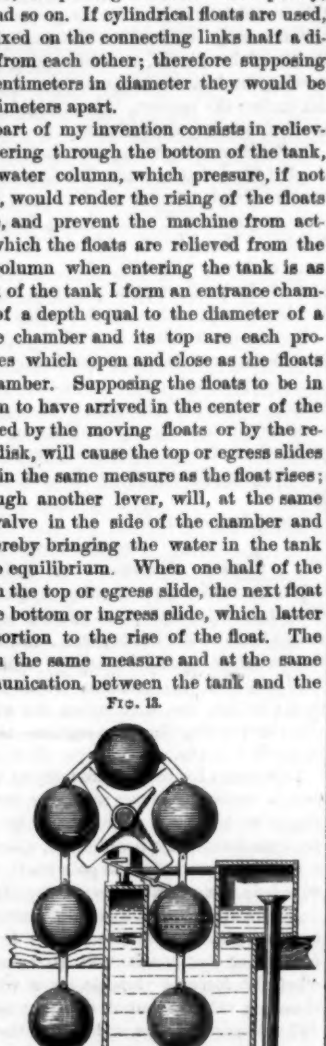


FIG 14.

"The details of arrangement and construction of my new motive-power engine may be altered or varied, but the main features of my invention consist in relieving the floats, when entering the tank, of the pressure of the water column by means of a vacuum chamber and parts connected therewith, as described, or their equivalents."

Only about a year since the *London Mining Journal* described a machine, patented in England, the essential features of which did not differ from those of Leonhardt; and what is more, expressed a favorable opinion of it.

We have received several letters with diagrams of "perpetual-motion machines" from correspondents, one of which we will herewith present, and defer others for future articles.

Fig. 14 is a diagram sent us by F. G. Woodward, whose address was not given in his letter.

The writer says: "It consists of a stand, A, two idler pulleys, C, between which a hollow cylindrical ring, suspended in the manner shown, is expected to revolve in the direction indicated by the arrows." The only difficulty about it is, that it will not work, though it looks plausible enough.

THE HAIL-STORM OF JUNE 20, 1870.

This remarkable storm swept along a path about thirty miles wide, and extending from Troy, N. Y., to Bangor, Me., though it was not everywhere accompanied by hail.

My point of observation was in Northampton, Mass., which was in the central line of the storm.

At sunrise the atmosphere was obscured by fog, which was partially dispersed at a later hour. The day was sultry. At noon the thermometer indicated 88° in the shade. At 3 P. M. a vast mass of dark-green cloud rolled up from the N. W., while lateral currents seemed to set in, forcing the clouds at first into confusion, but afterwards into a well-defined vortex, or spout. The electrical detonations were frequent and sharp. No rain preceded the hail, though it fell copiously after a few minutes. The first hail-stones were about one inch in diameter, and seemed to fall from a greater hight, and with more force, than those that fell subsequently. The latter were probably nearer the center of the vortex, and so had their downward motion restrained by that which was lateral. The first that fell were, most of them, on striking the ground, instantly buried out of sight. If they struck on a rocky surface they were dashed in pieces, or else rebounded to a considerable hight in the air. Had their larger successors been driven by a corresponding force, nothing could have survived their assault. The smaller hail-stones were generally flattened spheres, though sometimes in rude stellar forms, Fig. 1. But the largest ones were symmetrical ovoids; each being surmounted, however, by a roughened crown, Fig. 2. The dimensions and weight of three specimens are given, with such accuracy as could be secured by the means at hand. These are but samples of thousands that fell till the earth was covered with ice. The first was, in long diameter, $3\frac{3}{8}$ inches; short diameter, $2\frac{1}{8}$ inches; weight, 7 ounces. The second was $3\frac{1}{4}$ inches by $2\frac{1}{4}$; weight, 8 ounces. The third was 4 inches by $2\frac{3}{8}$; weight, 10 ounces. This monster, a foot in circumference, did not entirely melt away for six hours after it fell! The ice in all the hail-stones was peculiarly hard and compact. Interesting structural peculiarities were noted. Hail-stones of stellar form were always transparent and homogeneous. The spheroids were covered with an opaque coating, and had likewise an opaque center. On being bisected some of them showed a radiated structure, the alternate rays being white and clear, Fig. 3. The largest hail-stones had an axis of white ice, half an inch in diameter, around which the alternate layers were arranged in spiral convolutions, Fig. 4. The most common form was in concentric layers, like the coats of an onion, still alternating opaque and transparent; but the edges were finely serrated, like the stripes in some species of agate, Fig. 5. In one hail-stone I counted thirteen of these layers, indicating that it had passed through as many strata of snowy and vaporous cloud.

FIG. 1.

FIG. 2. $3\frac{1}{4}'' \times 2\frac{1}{4}''$.

FIG. 3. 2″ diam.

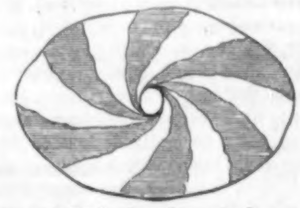


FIG. 4. $3\frac{1}{4}'' \times 2\frac{1}{4}''$.

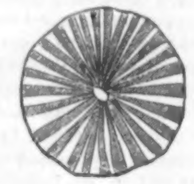
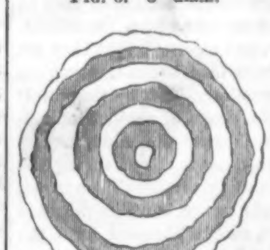


FIG. 5. 3″ diam.



After a lull in the storm, for half an hour, there was a second fall of hail, but much lighter than the first.

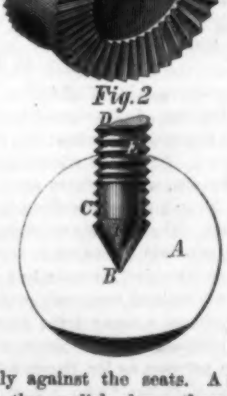
The damage done by such a war of the elements cannot easily be ascertained. Vegetation suffered greatly. In some cases men and animals were wounded. The icy missiles not only broke thousands of panes of glass, but also in many instances the window-blinds and sash. In a few cases weather-worn house roofs were pierced.—*Rev. Horace C. Hovey, M. A., in the American Journal of Science.*

IMPLEMENT FOR GRINDING VALVES.

This device was invented to supply an easy method of regrinding the Peet valve. The valve is an extremely efficient one, and has achieved, we are glad to say, great popularity. It is now extensively used both in this country and in Europe. The great durability of the valve renders regrinding seldom necessary, but when this operation is required the instrument under consideration supplies a very simple and ready means for accomplishing the desired object.

Fig.1

Fig.2



It consists of a pair of steel disks, A, made parallel like the valve disks, provided with serrated cutters upon their outer surfaces. Their interior surfaces are provided with wedge-shaped cavities, B, and the thread, C. The stem, D, is made with a screw, E, corresponding to the thread, C, in the disks. The conical wedge, F, is fitted to the cavities, B.

By removing the bonnet from the valve body, and placing the stem in its position in the disks, the grinder may be slipped into the valve body. A slight turn of the stem drives the wedge forward and forces the cutters firmly against the seats. A rocking motion of the stem will then polish down the valve seats to a perfect joint.

The valve disks are readily ground by placing a piece of fine emery cloth on a piece of planed iron and rubbing the disk face on it until it is perfect. The "Peet" valve is not

weakened by regrinding, as is the case with the globe valve, but it may be safely repaired many times.

The office of the Peet Valve Company is at 152 Hampden street, Boston, Mass., where users of the valve may obtain this grinding implement.

Correspondence.

The Editors are not responsible for the opinions expressed by their Correspondents.

Spiritualism and Science.

MESSRS. EDITORS:—The article under this heading, page 360. Vol. XXIII., is certainly well intended, serving to prevent persons of feeble mind from being deluded into mischievous notions of spiritual intercourse with departed beings, the basis of which is fallacious. Unless qualified, however, the said article is apt to confirm an error in another direction—an error which we find only too frequent. In proving the fallacy of the theory of spiritualism (as spirit manifestations, etc.,) phenomena of a quite different nature, having no connection whatever with the delusive theory—and which, by the way, are as stubborn facts as the growth of organism from the germ, or, indeed, nearly all animal function that at present baffles explanation—are classed under the same head, and, by implication, their existence is attempted to be disproved, for the reason that they are beyond explanation in the present state of scientific knowledge. We should, however, remember that we know absolutely nothing of many things, but that they take place, and only under certain conditions. The phenomena referred to are those generally designated as mesmerism, or animal magnetism, the powerful influence of the will of one individual upon the other, the trance produced, a more or less genuine clairvoyance, etc. That these conditions can be and are induced, no candid investigator in our time will deny; and that they are taken advantage of for deception is no reason to deny their genuineness under the proper conditions. Remember, there is nothing so noble that cannot be abused, or be made the guise for unworthy motives or actions. Love and the religious sentiment may be accepted as the most elevated conceptions which the human mind is capable of entertaining, and admitted that they are oftener perverted to base purposes than to good, we cannot denounce them as delusions, or humbug. That by the powerful will of the operator the whole system of another individual, bodily functions as well as those of the mind, may be controlled, was probably known and made use of among the first societies of men. They found that ills could be cured, insensibility to pain produced, and a trance, in which the mind appears to be to a greater or less extent liberated from the fetters of the body, the veil raised from an inner vision or perception, which penetrates through solid extraneous matter as through thin air; in fact, matter, distance, or time, ceases to interfere with a perception by which the mind places itself in communication with everything without and within. Admitted that the cases are rare in which the mind, while in such condition, is not influenced by the minds of surrounding individuals, nor by its own individual constitutional peculiarities, trainings, or aims. Finally, the faculty of giving utterance about objects or facts perceived, may be imperfect. But the rarity of a more complete state of the kind explained should not carry us so far as to deny the phenomenon itself. Prof. Gregory Ersdale and other investigators testify to the facts, though they fail to give an explanation for them.

It seems, however, a part of common human credulity to receive the rambling utterances of individuals in the state of trance, in a mood which favors deception, and, awe-struck, to connect them with communications from another world—instance the oracles of ancient and modern times. There is little disposition in general, or ability to examine if the condition is genuine, or unintentional, or purposely fictitious. And granted genuine, the utterances cannot be implicitly relied upon, because we are unable to detect to what extent the individual is influenced by the minds of others, by surrounding objects, or by its own individual constitution. This whole subject, moreover, is one too generally avoided by profound investigators, for the reason that they fear association with professional cheats and deceivers, or that they fail to recognize a tangible basis to start from, on which to build a system. The consequence is, that the phenomena are viewed with distrust and ignored, if not actually repudiated. In this manner, however, as we have seen in other branches of science, nothing is cleared up; the darkness remains, and under cloak of it cheats and impostors play their nefarious game.

Let us have light on this subject, if attainable, by starting from what we know of the working of the mind, and progressively learn what the mind may be capable of.

New York city. R. H.

[The whole subject of mesmerism was investigated by Dr. James Braid, of Manchester, England, in 1842, and his researches lead to the discovery of *hypnotism*, to which this class of phenomena can now be referred. There is no doubt about the partial sleep of certain faculties, while others are wide awake; and Dr. Hammond, of New York, gives remarkable instances from his own practice. The peculiar condition of nervous sleep, called hypnotic, which is produced in certain people by their fixedly gazing at an object, is entirely a subjective phenomenon, and does not depend upon any external force, electrical, magnetic, or nervous, coming from another person, but, under proper conditions, arises spontaneously, just like ordinary sleep. Some persons, as Dr. Hammond relates, pass into the hypnotic state of their own accord, and with the utmost readiness, and are "natural clairvoyants," or "spiritual mediums."

Unconscious cerebration has been a subject of study for a long time, and most of the phenomena are capable of scientific explanation. There is not the slightest necessity of making a mystery of them. Those who are "natural clairvoyants" are fit subjects for the care of a physician, and when they neglect the warnings of nature they are certain, sooner or later, to demand medical treatment when it is generally too late. Mesmerism served one good purpose, and that was to call the attention of scientific men to the possibility of performing surgical operations while the patient was insensible. Some of our older readers will remember that this was one of the strongest claims of the earliest advocates of mesmeric doctrines. The idea was at once seized upon as important, and in the course of researches on the subject, ether was suggested as an anesthetic agent. Afterwards, chloroform and nitrous oxide were employed, and in July, 1869, a new method of producing the hypnotic state was discovered in the hydrate of chloral, a medicine now largely employed for the purpose, and far more rational and effective than the laying on of hands, so popular twenty-five years ago.

Mesmerism, or hypnotism, is a subject for the physiologist to study; other persons had better let it alone.—EDS.

Deviation of the Plummet.

MESSRS. EDITORS:—The SCIENTIFIC AMERICAN for October 29, 1870, contains an editorial under the caption of "Central Shaft—Hoosac Tunnel." In that article you gave a lucid explanation of some of the difficulties the engineer would have to contend with when he made an attempt to lay down the line on the bottom of the shaft, but you forgot to mention one difficulty of considerable importance—you said nothing about the deviation of the plummets toward that side of the shaft upon which the greatest mass is located. That the plummets will lean toward that side is a foregone conclusion, Dr. Maskelyne's celebrated experiment with the plummet near Mount Schehallien, in Wales, having removed the subject beyond the pale of controversy.

To ascertain the amount of deviation I would suggest the following expedient:

With a No. 9 iron wire carry the surface line across the mouth of the shaft. Erect a thirty-foot pole upon either side of the shaft—their bases upon the surface line. Stretch another wire across the mouth of the shaft from the top of the poles. Suspend plummets from the upper wire, and by means of guys attached to the poles strain the points of the plummets exactly over the lower wire. Make all secure, and go below, taking with you two photographic cameras, so modified as will enable negatives to be taken of the zenith. Place one on either side of the bottom of the shaft, perfectly level, and on the tunnel line as established by the plummets. Of course there must be a line cut upon the back of the glass negative, and that cut line must cover the line of tunnel as established by the plummets. Photograph the wires overhead, and when the negatives are finished hold them between your eyes and a strong light. Unless I am very much mistaken, the photograph of the wires will appear like a thin wedge laid across the cut line at an acute angle, the apex pointing towards the center of the shaft. The right-hand plane of one wedge should, if extended, form the left-hand plane of the opposite wedge. The base of the wedges will show how much the tunnel line is out of truth. Photographs showing a clean single wire directly over the cut line will indicate that the true line for the tunnel has been found. Compare the true line with their other and their difference is the amount of plummet deviation.

Perhaps there will be three objections made to the foregoing method:

1st. The test requires too much nicety and perfection of workmanship.

2d. The shaft is too dark.

3d. The wires are too small.

As to the first, I reply that any method must be extremely nice, and the workmanship of the very best.

As to the second, the shaft may be dark so long as the wires remain in the light.

As to the third, it is untenable. In my possession there is a photograph on card-board showing the stem of an oak leaf which was 820 feet distant from the camera.

New York city. R. B. S.

Poisonous Effects of Bee-stings---A Preventive.

MESSRS. EDITORS:—The poisonous effects of a bee-sting can be prevented, or at least considerably mitigated, by passing over it the pipe of an ordinary trunk key.

The reason is obvious. The pipe acting as an annular compress close to the puncture, forces the poison out. Could not this simple process be extended in its application to the bites of serpents and rabid dogs? The absorption and spread of the virus might thus be prevented, or at least retarded, until a physician could arrive with a more effective remedy.

Albany, N. Y. ANTIDOTE.

Glass Cutting.

MESSRS. EDITORS:—The glazier's diamond is an angle of a crystal, the extreme point of which may be regarded as a single atom, which, when pressed upon the glass, acts like a wedge, entering between two particles of glass and producing a minute fracture. When drawn over the glass it produces an infinite number of minute fractures, extending sometimes quite through the glass. A sharp point of iron or lead will not cut glass because it is too soft. The extreme point or atom yields when pressed upon the glass, allowing two or more atoms to touch the glass, which act no longer as a wedge, but as a weight, and if sufficient force be applied, a large and irregular fracture will result.

A sharp point of hardened steel will cut glass nearly as well as a diamond. Take an old worn-out three-cornered file, grind the end to a three-cornered point, heat it red hot, and immediately plunge it into a mixture of snow and salt. Retouch it on the stone to remove the scale, and it is ready for use. If rightly done it will give very good satisfaction. In using it hold the file nearly perpendicular, slightly inclined forward, and with a gentle pressure draw it rapidly over the glass without changing its inclination to the surface. In cutting thick glass it is safer to cut on both sides before attempting to separate the pieces, but thin glass may be cut with the greatest facility. When the point becomes dull from use it will produce only a ragged surface—scratch—but will not cut. It then needs regrinding. A single turn of the stone is sufficient to put it into working order again.

I find such a glass cutter very serviceable for preparing glass for honey boxes and for various other purposes.

J. H. P.

How to Prove a Millstone Level.

MESSRS. EDITORS:—I think the writer of the article in a recent number of the SCIENTIFIC AMERICAN, headed "How to Prove a Millstone Level," is in error. Suppose the bedstone to be level, and the spindle trammed to it; put on the runner, raise it from the bedstone, and set the runner in motion. Now the runner may be out of balance, if so it will click on the bedstone. Will this prove the bedstone is not level?

Again, the writer says another way to make the stones come evenly together is to move the bottom of the spindle *from* the lowest side of the bed stone. If the runner was fastened on the spindle, so as to have no play on the top of the spindle, this would be correct. But at present the irons in millstones are so arranged as to allow the runner to balance and play on the top of the spindle, so that inclining the top of the spindle by moving the foot of the same in an opposite direction, would not incline the runner. If it would, there would be no real need of leveling the bedstone.

I will now give you my plan to level a millstone. Procure a spirit level that is true. But how shall its truth be tested? Easily enough. Lay it on your proof staff, or red staff, if you have no proof staff. Now bring the staff to an approximate level, and change ends with the level, and if it shows the same each way it is true. If it is not true, plane off the bottom of the level, or paste paper on one end at the bottom of the level, until both ends show alike.

Having the bedstone in good face, proceed to level it. The level being true, the stone leveled by it will be true, and will need no proving. Now tram the spindle to it, put on the runner, and set it in motion. The spindle being tight in the step and bush, if the runner ticks on the bedstone, it will not prove the bedstone is not level, but it *will* prove that the irons are not properly fitted, or the runner is out of balance, or both.

Grand Haven, Mich. THOMAS BRADFIELD.

Sounds Produced by Telegraph Wires.

MESSRS. EDITORS:—Having frequently noticed the humming from telegraph poles alluded to by F. P. Dodge, in a recent issue of the SCIENTIFIC AMERICAN, I have no hesitation in assigning said humming to the action of the wind. The telegraph wire forms an Eolian harp, of which the wind is the motor, the wire string the vibrating body, and the poles suspending the wire regulate the tension upon which its pitch depends.

To account for special intensity of sound from a particular pole, a variety of causes may operate and contribute either singly or together. These may be the near presence of a good conductor, as a board fence, a sewer, or covered ditch, or a firm foundation for the pole itself, the adjoining length of wire being exposed to a particular blast or current.

A wire stretched at a certain tension, between unyielding bearing points, and vibrated by the same force, whether plucked or continuous, will give out the same tone. But when the force is variable, as a wind current, not only of changing velocity, but of different densities and velocities at different parts of the string, and the poles or bearing points yield under the changing stress, the wire gives out a ground tone, which rises and falls in accordance with the variability of motor and materials. Add to this tone the higher ones resulting from the string breaking into smaller divisions of vibrating length, and there results the peculiarly wild and uncultivated whining of the Eolian harp, which represents musically all that is uneasy, weak, and miserable.

Professor Tyndall's work "On Sound" gives with admirable clearness a full review of vibrating bodies, whether cords, rods, plates, or pipes.

Washington, D. C. C. W. CHAPMAN.

The Mississippi Bridge at St. Louis.

MESSRS. EDITORS:—You have recently had several articles in regard to the progress of the great bridge across the Mississippi at this place. Difficulties unseen, or, rather, unexpected, which presented themselves in the sinking of the two channel piers, have been guarded against more effectually in the details and machinery of the abutment caisson, with the happiest results so far. Although this pier is much larger and must go much deeper than the east pier, the arrangements are so complete that the engineer experiences no anxiety about the abutment being safely placed on the bed rock of the Mississippi without accident of any kind. The rate of its descent during the last three weeks has averaged nineteen inches per day, thirty inches being the greatest day's work in that time. The masons have been laying stone night and day, eight traveling hydraulic purchases being used to supply the stone and mortar to them. The rate of descent named involves the laying of about 100 cubic yards of stone per day of 20 hours. The penetration of the pier is now 43 feet 6 inches below the surface of the river, 57 feet still intervening between it and the bed rock.

The operations at this pier have been suspended for the last three days, owing to extreme cold weather and the river being gorged with ice. The front of the pier stands out in the river about 100 feet from the Illinois shore, and the derrick pontoon or barge about 40 feet further. On this barge are 6 large steam boilers, 4 or 5 flues each, about 26 feet long and 44 inches in diameter, 2 steam engines driving air pumps, 2 ditto driving traveling purchases, 3 driving hydraulic rams, 8 hydraulic lifting jacks for hoisting stone, 5 large Cameron steam pumps to drive sand pumps, besides smaller ones for each battery of boilers (four in all). In fact this barge, *G. B. Allen*, is loaded down with a precious freight of most valuable machinery, and should she sink it would cause great trouble. To prevent this she is thoroughly bulkheaded into eight water-tight compartments, and a strong ice apron has been established above her to deflect and break up the ice as it comes down. This is now running so heavily as to thoroughly prove the apron to be a success, the ice being turned off from it like turf from the plow.

The river is so nearly blocked this morning that the ferry-boat can scarcely cross, even below the channel piers, and the ice is so heavy and moving so slowly that a close of the river is confidently expected if the cold continues many hours more.

The river is very low now, but I think it quite likely that 20 feet more will have to be worked through before getting down to the rock; this would give about 120 feet of water. Thirty working days will suffice to put the pier to the rock.

St. Louis, Mo. A. B. C.

Special Correspondence of the Scientific American.

EASTERN LONG ISLAND---MENHADEN OIL AND THE FISHERIES.

SAG HARBOR, Dec. 9, 1870.

This is by no means the most pleasant season of the year to visit this end of Long Island, but business and pleasure do not always go together. This place, once one of the largest and most important of the whaling towns, now does almost no business in that line. Once they fitted out more than twenty good-sized ships every year, now two or three constitute the whole number.

The town has lately received some impetus from an extension of the Long Island Railroad to it, but it is hard for a seafaring population to learn new tricks. It contains one good-sized cotton factory, run by steam, and a large steam flour mill. Through the politeness of Mr. R. S. French I had an opportunity of seeing the place in its best aspect. It is much resorted to in summer, and its hotels are always crowded during the warm season. I could easily see the good one might derive from the sea breezes and recreation under the shade of the great elms around the Fordham House, or lolling lazily on a yacht floating down the bay.

The history of the cotton factory is that of too many similar institutions. As a corporation two distinct capitals were sunk; now it is in the hands of one man, and he makes it pay.

South of this place is the ancient town of East Hampton. With its venerable church, its cemeteries with their quaint old tombstones, its old-style houses, and good, honest old-fashioned people, not to speak of its excellent boating and fishing, and superb bathing beach, it has become not only a curiosity, but a favorite resort for hundreds of New Yorkers. A change is what the wearied city man wants, and in East Hampton he finds most emphatically the opposite of New York.

The Old Church is built chiefly of oak and juniper. There are timbers in it, perfectly sound, yet it is over 220 years since they were cut and hewed. The original church was built in 1649; this one was built partly of the old materials in 1717, and, unfortunately, somewhat remodeled in 1824. The frame is so strong that I think it would be possible to roll it over without starting a joint. The tie-beams are 8×10 inches and the rafters 8×4, with braces 6×4, and supports the same—all of hewn white oak.

The town is a singular place. It has one long wide street with a cemetery at each end, and there are not more than two or three modern styled houses in it. By far the greater portion of the houses are shingled on the sides, and are unpainted.

The power used for grinding corn, etc., is the old-style windmill. There are three in the village; one was running. We said to the proprietor, "Why don't you paint your mill house, your shingles will last longer?"

"Well, it's been here as it is for over seventy years, and I guess it won't hurt much more than it has."

The town is simply a well-preserved relic of more than one hundred years ago, and as such is well worth a visit. As we were leaving, about the only man we didn't find pretty near asleep halloed out, "Tell the folks up in New York you found one live man in East Hampton, and that's Bill Gardiner." Asleep as they are, they are good farmers, good livers, and honest, hard-working people.

To this same live man we are indebted for much information about the menhaden fisheries. If the whale fishing has decreased the menhaden fishing has been found fully as profitable, and a much less dangerous substitute. The business was first commenced in Massachusetts. The first factory on Long Island was started about twenty years ago. The new style of oil did not sell well at first, but since the decay of the whale fisheries the business has grown into enormous proportions, and is immensely profitable. There are now about twenty factories on Eastern Long Island, and several in New Jersey. These hereabouts took last season about 70,000,000 fish. One seine caught during the season 1,500,000, and there is one factory which has the ability to take care of 200,000 per day.

The fish which are used for this oil-making is called "menhaden," "porgie," and "moss-bunker," and some say it is the same as the bony shad. The fish are caught in seines. Some of the men work on shares, each owning a part in a boat, and running risk of good catch, weather, etc. Some such, thus working, we were informed, made this year $1,033 each. Some of the factories own their boats and hire the men, others depend on buying. In the spring, when they first commence running, the fish sell for $2 per thousand, as they are poor then, and only yield about four gallons of oil to the 1,000. As the season advances they get better, and sell for $3 in the fall, and yield some as high as 18 gallons of oil per 1,000.

In making the oil the first are put in large tanks, and boiled with free stream; the oil and water are drawn off, and the residuum is pressed. This gives more oil of an inferior grade. The pummace is sold as fish guano for $20 per tun. It is an excellent fertilizer, and very generally used by the farmers of this section. It is also bought by manure-makers in New York and elsewhere, and mixed with phosphates, bone, and other less valuable matters. We think that mixed with a small quantity of ashes and a greater proportion of cotton-seed cake, it would make a first-class manure for the South. One manufacturer told me that he had made this year 1,800 tuns of this pummace. A great deal of it is now shipped South, and on Shelter Island there is a fertilizer factory which mixed it with Charleston phosphates.

Greenport is rather the headquarters of this fish and oil interest, and a large number of the factories are on Shelter Island opposite that place. The old frigate *Falcon* was some time ago purchased, and has been fitted up as a floating factory. The steamer *Algonquin* has lately been purchased for the same purpose. The object in having these floating factories is two-fold: if the run of fish is bad in one locality they can move; again, the smell from them is none of the pleasantest, and hence the inhabitants around the stationary factories frequently complain. That being the case near a floating factory they "up anchors" and move out of the way of injunctions.

This oil, the manufacture of which has become such a great interest to this end of Long Island, if well made, is a clear, bright-lemon color, sweet, and with but little fish smell or taste. Such oil, however, is rare, and sells at much higher figures than the ordinary grades—usual price 55 cents and 60 cents per gallon. There is, however, a great deal of very good oil made of a dark-lemon color, and from that to red. It is chiefly used for adulterating other oils and for manufacturing various patent or special lubricating oils. As an adulterant it is principally used in whale and tanner's oils. Well made it sometimes goes into low grade sperm. It has been put in linseed oil, but the cheat is there too easily detected, by simply dropping a little of the adulterated oil on hot iron.

It is one of the singular facts of our life experience, that wherever one of Nature's supplies becomes scarce, she raises up another to take its place. This fish interest is every year increasing, and we thought there might be a chance that all the little bunkers would be caught up, but some of the old fishermen told us they were more plenty than ever.

From these facts it will be seen that this business is one of considerable importance, and employs not only a large capital but many men. Greenport is the great seat of this industry, and every inhabitant is in some way interested in it. For the accommodation of the vessels engaged in it the United States Government has just ordered the erection of an iron lighthouse on the point of Shelter Island, just at the entrance of Peconic Bay. Both Great and Little Peconic and Gardiner's Bays are beautiful sheets of water, and much resorted to by yachtsmen in summer. Every island and spot of the shore is hallowed by reminiscences of our early settlers, and wild traditions of the Indian aborigines.

H. E. C.

[For the Scientific American.]

WHAT CAUSES AURORA BOREALIS?

BY DANIEL KNODE WINDER.

In a recent letter, Mr. Proctor, F. R. A. S., remarks that "there is no generally received theory of the aurora." This, when we take into consideration the number of theories which have been proposed, is remarkable indeed.

A review of them indicates that there has been no lack of careful observations of the phenomena, and that very many of them have been correctly interpreted; and yet no theory is found adequate to meet all the requirements of the case.

Professor Loomis suggested that the light is produced by a current of electricity which flows outward from the equator of the earth, and inward at its poles; and Mr. J. E. Hendricks attributes it to a similar current of ether or air; and, although both are correct, they fail to give us an explanation of the way in which these currents cause the diversified phenomena.

In a recent number of the SCIENTIFIC AMERICAN, Professor Van der Weyde has demonstrated that interplanetary space is filled with a ponderable, but exceedingly rarefied medium. This, too, is certainly an important step toward a correct interpretation of the phenomena in question.

Why is it, then, that we are still left without the long-sought-for theory that will explain all the facts connected with the Northern Light?

I think the reason is that heretofore we have failed to recognize a number of well-established facts in regard to the nature of the forces—electricity, heat, and light. Believing this to be so, I determined to bring together all known facts relating to these forces, now generally believed to be correlated—and as the learned Tyndall has shown, but modes of motion—and having them before me to see if we should not learn more concerning their nature. With what success my labors have been rewarded, the scientific world will decide.

I am happy to say that one of the results which this letter is intended to present to the readers of the SCIENTIFIC AMERICAN, is a full explanation of the way in which electricity produces the diversified phenomena of Aurora Borealis.

Many established facts connected with the movement of electricity, heat, and light, have satisfied me that they are but one force, which is simply motion, undulating and progressive; and that the difference between them consists in the length and rapidity of their wavelets. I find, too, that force changes from waves of one length to another, and that the change results from the nature of the medium through which it is passing. The waves of electricity are shortest, those of heat longer, and those of light the longest, adapting them to the larger sizes of the molecules in a rarefied medium.

Let us now notice the changes in motion, as it passes from the sun to the earth. It exists in the body of the sun as electricity; in passing through the photosphere, owing to its insufficient conducting capacity, but a small portion retains its original form, and the excess is changed to waves of heat-length (this accounts for the heated condition of the photosphere of the sun), then, entering the rarefied medium which fills interplanetary space, it is changed to swifter and longer undulations, and in the form of light passes through space to the earth's atmosphere; there the resistance of air retards its waves to the form of heat, in proportion to the density, and passing to the earth, the force is changed (both light and heat) to the original form, electricity.

Now, I think we can explain the cause of auroral light. The currents flowing outward from the equator of the earth and inward to its poles, must increase motion in the molecules of the rarefied medium in the elevated region through which it passes; then, the property of diffusion, which force manifests, causes a flow to the surrounding molecules of atmosphere and to the earth. Now motion in that elevated region can only exist as light, and is the Aurora Borealis. But it must be remembered that it cannot be seen as luminous aurora until it enters the earth's shadow.

The upper edge of the dark bank beneath the luminous arch, in brilliant displays, marks the line along which the change from light to heat-length waves occur.

It may be said that the flow of the equatorial current being regular we should have aurora constantly. I reply that this is certainly true; but not in such quantity as to be visible, only at such times as there is more than ordinary flow of motion from the sun to the earth, which would correspondingly increase the equatorial flow of force. [The words motion and force are synonymous.] And it is the corresponding increase of the current inward at the poles of the earth that causes the agitation of the magnetic needle. Now, from this we may readily see the reason why the records of observations show a coincidence of the maxima and minima periods of sun spots, aurora, and magnetic storms.

When the auroral region is quiet, we have displays of steady light, but when disturbed by winds, or the inflowing current of air, there are dark spaces, by interruption of the flow of force, gently moving beams, or waving currents, while the grandeur is increased by reflection from masses of vapor always present during the displays.

Thus we see that the phenomena of Aurora Borealis are the results of the movement of electricity, heat, and light—the three forms of cosmical force.

Toronto, Ontario.

Manufacture of Buttons.

The first manufacturer of buttons in this country was Samuel Williston. While he was dragging along as a country storekeeper—his eyes having failed him while studying for the ministry—his wife bethought her that she could cover by hand the wooden buttons of the time, and thus earn an honest penny. From this the couple advanced in their ambition until they had perfected machinery for covering buttons; the first employed for the purpose in this country. From this sprang an immense factory, and then others, until Samuel Williston made half the buttons of the world. His factories are still running at Easthampton, coining wealth for the proprietors, and known to every dealer in buttons the world over. He is now between seventy and eighty years of age, is worth five or six millions, and has given $400,000 to Easthampton for a seminary and for churches, $200,000 to South Hadley Female Seminary, and $200,000 to Amherst College, besides lesser gifts.

BEET-ROOT SUGAR IN CALIFORNIA.—The *News Letter* says: "No one article in all the notices of the California Beet Sugar Company begins to do the affair justice. We publish a few facts to correct the bungling misstatements made in the dailies during the past week. Two hundred and fifty barrels of A-1 sugar stands credited to shipment No. 1, with many more ready at mill to end over, and beets enough on hand to make two thousand barrels first-class sugar, besides second-class, sirups, etc. The mill, when running to its full capacity, will work fifty tuns of beets per day: they are now running through about forty tuns every twenty-four hours. They have one hundred head of cattle under cover to fatten on the pulp. The managers met with no difficulties in reaching the result they have, the parties engaged in the affair knowing their business. They owe no one, and, so far as we can learn, there is no stock for sale, except at a premium."

THE publishers of the *Shipping List*, contemplating a change in the mechanical department of their paper, offer their press, engine, etc., for sale. See advertisement in another column.

IMPROVED SELF-LOCKING STOVE LEG.

A letter from one of our correspondents, published some time since in this journal, called attention to the unsafe character of the method of dovetailing stove legs. This letter called forth several others, which recounted accidents and narrow escapes from accidents resulting from the loosening of stove legs and the spilling of charges of burning coals, kettles of hot water, etc., whereby injuries of a severe character were in some instances received.

Several improvements in methods of fastening stove legs were suggested by the correspondence referred to, one of which is illustrated herewith. Two views are given, one being a perspective view and the other a sectional view.

It will be seen that the stove plate has cast thereon a stout hook instead of the usual dovetail. The hook fits into an eye in the upper part of the stove leg. That part of the eye marked A in the figure, is straight and has its vertical diameter longer than its horizontal diameter. To insert the hook or to take out the leg it is necessary to place the leg in the

position shown in dotted outline in the sectional detail. This requires the raising of the stove bodily from the floor an inch and one half or two inches. In no other way can the leg be loosened. So long as the stove rests upon it, it cannot be moved in any direction.

The hook on the plate is easily cast, the pattern being separated on the dotted line of division marked B. The body of the plate is first drawn, with the upper part of the hook, and the point of the hook is then picked out of the sand without trouble. We see no objection to this mode of constructing and attaching stove legs, while it affords ample security against the class of accidents above spoken of, without additional cost in the manufacture.

Patented Oct. 4, 1870. Address, for rights or other information, S. E. Chubbuck & Sons, 971 Tremont st., Boston, Mass.

GUN COTTON.

Gun cotton is soluble in wood alcohol; one liter dissolves eighty grammes, but the solution is liable to change, owing to the production of formic acid.

The insolubility of gun cotton in nearly all liquids suggests its use for filtering sulphuric acid, chromic acid, permanganate of potash, caustic lye, solution of chloride of zinc, aqua regia, etc., and it is much employed for that purpose.

The Austrian method of making gun cotton for military purposes is as follows:

Cotton thread is twisted into yarn and then immersed for a few minutes in nitric acid, afterwards completely washed in water, wrung out, and dried at 129° Fah., and finally treated with a mixture of nitric acid of 1·52 specific gravity, and sulphuric acid of 1·14 specific gravity. Equal parts of these acids are taken and left to stand twenty-four hours after mixture, and the yarn is then introduced and left for forty-eight hours; it is then thoroughly washed in running water, immersed once more in potash soluble glass, and finally dried for use.

Gun cotton is now made into ropes for storage, and kept under water. When an order is received at the manufactory, a few hours suffice to dry it ready for transportation.

It has been found that by making the ropes with many air channels through the mass, the cotton explodes almost instantaneously, and is as violent in action as the fulminates. Charges for guns are now made into two parts—an exterior composed of cotton of loose texture, the ignition of which starts the ball, and an interior of denser material, which supplies the gas for accelerating the speed of the ball. The result is great gain in initial velocity.

Barnwell and Rollason's patent for new and peculiar products of gun cotton claims that rags can be employed instead of cotton. They make collodion in the usual way; to this is now added any of the pure animal or vegetable oils, and a new liquid is formed, to be used as a cement. Gums and resins afford a cement which may be rolled out into sheets and formed into cups, fancy boxes, etc. Oxide of copper imparts a green color, chloride of lime renders it uninflammable. It is recommended for dentists' and jewelers' use. The collodion oil can also be used as a varnish. Gun cotton reduced to a powder and mixed with niter and saltpeter, as a substitute for charcoal, makes a superior gunpowder.

J. Scott Russell says in his report, read in 1863, before the Mechanical Section of the British Association, that Baron von Lenk, of the Austrian Artillery, has discovered the means of giving gun cotton any velocity of explosion that is required by merely varying the mechanical arrangements under which it is used. Gun cotton in his hands has any speed of explosion from one foot per second to one foot in ·001 of a second. The instantaneous explosion of a large quantity of gun cotton is made use of when it is required to produce destructive effects on the surrounding material. The slow combustion is made use of when it is required to produce manageable power, as in the case of gunnery. It is plain, therefore, that if we can explode a large mass instantaneously, we get out of the gases so exploded the greatest possible power, because all the gas is generated before motion commences, and this is the condition of maximum effect. It is found that eleven pounds of gun cotton compressed into one cubic foot produces greater force than fifty to sixty pounds of gunpowder occupying the same space.

Gun cotton is used for artillery in the form of thread or spun yarn. In this simple form it will conduct combustion slowly in the open air, at a rate of not more than one foot per second. Some of the advantages claimed for this kind of gun cotton are:

CONVEYANCE AND STORAGE.—One pound of gun cotton produces the effect exceeding three pounds of gunpowder in artillery; this offers an advantage in transportation. It may become damp, and even perfectly wet, without injury, and can therefore be easily stored.

PRACTICAL USE IN ARTILLERY.—Gun cotton keeps the gun clean and requires less windage, and therefore performs much better in continuous firing; it also does not heat the gun as gunpowder does. There is less smoke, no poisonous gases, and the men suffer less inconvenience in firing. There is smaller recoil, greater velocity, and less weight of gun can be employed.

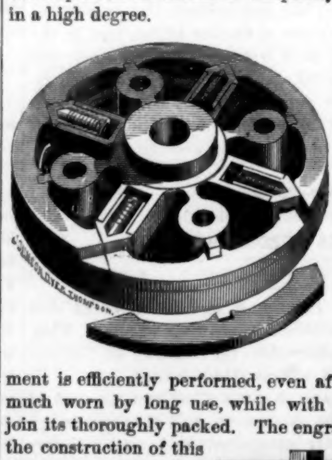
EXPLOSION OF SHELLS.—Shells are exploded into more than double the number of pieces, in consequence of the expansion of the steam and gases when the gun cotton is confined very closely in very small spaces. It is also a peculiarity that the stronger and thicker the shell the smaller and more numerous the fragments into which it is broken.

MINING USES.—Gun cotton is highly commended for this purpose, and is stronger than gunpowder, weight for weight, in the proportion of three to one in artillery, and six to one in solid rock. It is used for blasting in the form of a hollow rope, and after a little experience its splitting power can be regulated at pleasure.

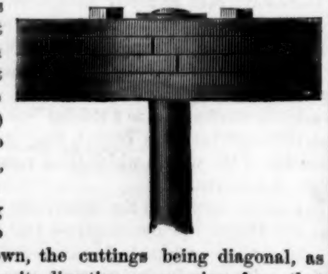
MILITARY AND SUBMARINE EXPLOSIONS.—It is a well-known fact that a bag of gunpowder nailed on the gates of a city will blow them open. A bag of gun cotton exploded in the same way produces no effect. The gun cotton must be confined; in a bag it is harmless; exploded in a box it will shatter the gates to atoms. According to actual experiments made in England, a small square box containing twenty-five pounds of gun cotton, simply thrown against the palisades of a fortification, will open a passage for troops, while three times the quantity of gunpowder would produce no effect whatever, except to blacken the piles. Explosions of gun cotton under water were found to be equally effective. A more detailed account of the uses of gun cotton and collodion must be reserved for a future communication.—*Prof. Joy in Journal of Applied Chemistry*

CHUBBUCK'S PATENT PISTON AND PACKING.

The engravings accompanying this article show the construction of an improved piston and packing which have met with great acceptance for stationary and marine engines, and which possess the merits of simplicity and delicacy of action in a high degree.



The parts are all accessible for inspection, the weight is supported independently of the packing, the packing automatically adjusts itself to any slight taper there may chance to be in the bore of large cylinders, or any want of truth in the bore consequent upon strain, springing, or other causes; and this self-adjustment is efficiently performed, even after the piston has been much worn by long use, while with minimum friction the join its thoroughly packed. The engravings so plainly show the construction of this piston and packing that a very brief description will suffice to make it clearly understood. The rings (two in number) are placed between two solid disks. The rings, instead of being continuous, are, after being turned true, cut into four segments, as shown, the cuttings being diagonal, as shown, and in an opposite direction, on one ring, from that of the other, so that when placed in position they shall break joints.



The method of cutting the rings leaves wedge-shaped recesses where the ends of the segments meet when placed in position, and into which the ends of radially expanding wedges are thrust by coiled springs acting in radial lines from the hub of a spider, as distinctly shown in the engraving. The expanding wedges run in guides, as also shown, and by their action on the segments of the ring, cause them to continually press gently outward against the sides of the cylinder, and thus taking up the inevitable wear, to keep the integrity of the steam joint unimpaired without excessive friction.

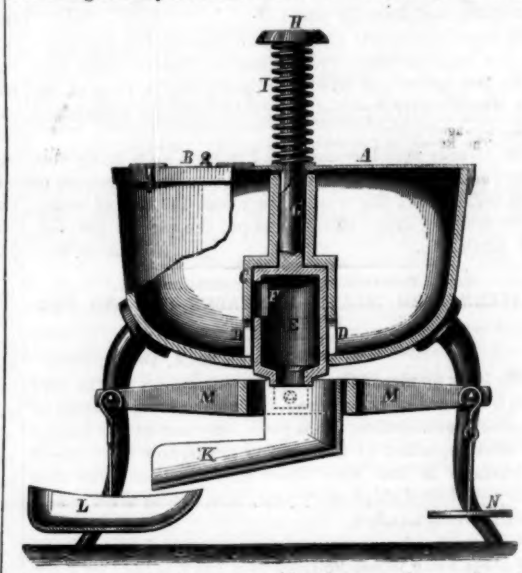
The device is also adapted to use as water packing in pumps, etc.

Patented February 28, 1868. Address for further information S. E. Chubbuck & Sons, 971 Tremont street, Boston, Mass.

BOOTON'S SHOT CASE AND DISTRIBUTER.

The object of this device is to supply to retail dealers a convenient case for holding the various sizes of shot, and also an apparatus whereby they can be conveniently weighed out in parcels as desired.

The body of the case is a metallic vessel, shaped like a kettle, and supported on suitable legs. Vertical partitions extending radially from the center to the shell of the case



divide the space into as many chambers as the number of different sizes of shot desired to be kept therein.

A circular cover, A, having a hinged door, B, formed therein, through which the shot are put into the case, extends over and closes the top of the body of the case.

From the bottom of the body rises a hollow cylinder, C, which cylinder communicates with the several chambers by apertures, D. Within the cylinder, C, is still another hollow cylinder, E, having an aperture, F, formed in it, and from the top of which rises a shaft, G, terminated by a knob, H. The lower part of the cylinder, E, protrudes through an aperture formed in the bottom of the case, and is held from falling by a coiled spring, I, which surrounds the upper part of the shaft, G, and expands between a collar attached to the center of the cover, A, and the knob, H. A feather is formed in the side of the shaft, G, which engages with the collar in the center of the cover, and turns the shaft, G, and the cylinder, E, about on their vertical axis, whenever the cover is turned; so that the cover and the cylinder, E, always occupy the same positions relative to each other.

The cover, A, being turned so as to bring the aperture, F, over one of the apertures, D, the hand placed upon the knob, H, presses down the shaft, G, and the cylinder, E, so that the aperture, F, is brought down over one of the apertures, D, and communication with the exterior of the case is established with the chamber inside the case to which the aperture, D, belongs. The shot in that particular chamber, then flow out into the cylinder, E, and thence into the chute, K, and thence down into the pan, L, of a balance, M; a suitable weight having been placed on pan, N, the hand releases the knob, H, as soon as the weight of the shot in L counterpoises the weight on N, and the coiled spring instantly raising the cylinder, E, into the position shown in the engraving, stops the flow. By raising the hand as the proper weight is approximated, the flow may be graduated so as to make it as small as may be desired, and to prevent any more flowing into the pan than will just turn the balance. An index, O, is attached to the cover, which, in connection with a suitable graduation in the side of the case, renders the turning of the cover to the proper number easy and certain.

Patented, through the Scientific American Patent Agency, January 3, 1871, by Sinclair Booton, whom address for rights and further information, care T. D. Johnston, San Antonio, Texas.

Iron Around Peach Trees.

At a recent meeting of the American Institute Farmers' Club, Mr. Wagner, who lives on Long Island Sound, about fifty miles east of New York, exhibited some pruning from his orchard to illustrate the effect of putting iron around trees. He took an old place with twenty trees in the orchard, full of dead limbs, with yellow leaves, and the crotches oozing thick gum. He gave the earth a good top dressing of iron, breaking up old plows and scattering the fragments. The effect has been marvelous. The trees have renewed their youth, and now look strong and thrifty. The bark is tight and leaves are green, and the borer has disappeared. He thinks the slag of iron furnaces, ground up and spread on orchards will prove a very valuable fertilizer for fruit trees of all kinds.

EACH of the scientific periods of time, except the century, simultaneously close with the year 1870, viz.: the decade year, month, week, day, hour, minute, and second.

Scientific American,

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW (PARK BUILDING), NEW YORK.

O. D. MUNN. S. H. WALES. A. E. BEACH.

☞ "The American News Co.," Agents, 121 Nassau street, New York.
☞ "The New York News Co.," 8 Spruce street, New York.

☞ Messrs. Sampson, Low, Son & Marston, Crown Building, 185 Fleet street, Trubner & Co., 60 Paternoster Row, and Gordon & Gotch, 121 Holborn Hill, London, are the Agents to receive European subscriptions. Orders sent to them will be promptly attended to.

☞ A. Asher & Co., 20 Unter den Linden, Berlin, Prussia, are Agents for the German States.

VOL. XXIV., NO. 2 . . . [NEW SERIES.] *Twenty-sixth Year.*

NEW YORK, SATURDAY, JANUARY 7, 1871.

Contents:

(Illustrated articles are marked with an asterisk.)

WHERE IS THE LIMIT OF INVENTION?

Let one take up the Patent Office Reports, beginning with the first volume, and pass cursorily through them to the very latest, and he will, if not familiar with the number of inventions which are there recorded, probably be struck with astonishment, and rise with a feeling that after all this struggle for the complete mastery of the physical forces, there must remain very little to be done; that the field must have been worked nearly or quite entirely over, and that scarcely anything, in comparison, can remain for inventive talent to grapple with.

A closer and more rigid examination would, however, correct this mistake. Scrutinizing the character of each invention separately, he would find that by far the greater portion of even those entitled to be called useful, at the date of their devising, can, from the very nature of things, only remain useful till some advance in other departments renders them obsolete, and creates a want for other and entirely different appliances.

Besides this, each important invention is the parent of a large family of minor ones. See how numerous are the inventions which have been born of the application of steam as a motor. Governors, cut-offs, boilers, boiler feeders, high and low-water detectors, low-water alarms, steam whistles, valves, cocks, steam-engine indicators, apparatus for testing the strength of boilers, etc., etc., have been invented, each one of the classes specified or omitted including, we had well-nigh said, countless inventions of greater or less utility.

A discovery of means whereby electricity could be so cheaply employed as to exceed, or even to compete on equal terms with steam, as a motive power, would be inevitably followed by generation after generation of inventions, till the whole civilized world would teem with them. It would take a long time to cull out and count the inventions born of the Morse system of electro-magnetic telegraphy, yet this system is scarcely more than a quarter of a century old. The introduction of insulating cables for submarine telegraphy, and the extension of the system to very long distances, created a demand for more delicate recording apparatus, which, notwithstanding the large number of exquisitely ingenious devices created to supply it, is still unfilled.

"The eye is never satisfied with seeing, nor the ears with hearing." The human mind constantly feels a craving for something more than it possesses. Any creation of inventive genius which appeals to this craving is sure to be received with favor, be it nothing more than a sixpenny toy.

Looking at the progress of invention in this light, it will be seen that instead of approaching its ultimate limit, the field enlarges as we advance. In short, it has no limits. It is infinite as is the capacity of mankind to desire. We are all of us to-day longing for swifter means of travel and communication; for cheaper books; for more extended educational facilities; for more powerful instruments of scientific investigation; for fuller gratification of our tastes in the arts; and we are willing to employ, and keep employed, the creative genius which devotes itself to the supply of these wants.

Every announcement of a new discovery in chemistry or physics, heralds to the world the fact that a new "placer" has been opened, wherein rich veins of ore may perchance be found by the skilled inventor. When "oil was struck" in Pennsylvania, a few years since, who would have dared to predict the extent of the field it opened to inventive genius? No doubt the mechanical devices and chemical processes to which it has given birth may be numbered by thousands, and the improvement in the general welfare of the race, resulting therefrom, is simply incalculable.

No, the end is not yet; and it will never come so long as man remains constituted as at present. There are as many chances to win now in invention as there ever were, but it requires now higher qualifications for eminent success. The more inventions multiply the greater the necessity for higher standards of technical education, and the more general diffusion of theoretical as well as practical knowledge.

THE PROFESSION OF THE MECHANICAL OR DYNAMICAL ENGINEER.*

The term "Mechanical Engineer" is a very unsatisfactory one, and its meaning is very indefinite. To some it conveys the idea of practical engineer; another will confine it to the profession of steam engineering, while the courses of study designed to fit young men for the profession of mechanical engineering are variously styled as "Mechanics and Engineering," "Applied Mechanics," "Industrial Mechanics," and "Applied Mathematics."

The necessity for a more accurate defining of the limits of the two great branches of engineering which in the terms "Civil Engineering" and "Mechanical Engineering" have had a very imperfect line of demarkation, has impelled the Sheffield Scientific School of Yale College to apply a new and more definite term, "*Dynamical Engineering,*" to the chair of "Mechanical Engineering," in that institution.

In the inaugural address of Prof. Trowbridge, the reasons for the adoption of this term are given by him as including those we have already stated, and he adds that its indefinite character

arises from the fact that the term "*Mechanical*" is not employed in the sense which it would derive from the word *Mechanics*, as descriptive of a science of mathematically applied principles; but from the more restricted sense in which it is used to designate the work of construction of a machine, and the labors of the artisan or mechanic. If originated in the large machinery establishments, and at first referred especially to the manipulations necessary to produce and combine the material parts of a machine, rather than to the intelligent application of the laws of statics and dynamics, in designing and adapting machinery for the performance of specific work. In the sense derived from the word mechanics as a science, civil engineering is also a mechanical science; the only difference between this and mechanical engineering being that one is based on the principles of *statics*, and the other upon *dynamics*. These considerations would have little importance if the questions involved were merely those of words; but, as before remarked, they involve confusion of ideas, especially in the popular understanding of the subject. It has not always been deemed essential, for instance, that a mechanical engineer should be thoroughly acquainted with the *science* of mechanics, and his calling has been regarded as a trade or an art, rather than as a learned profession; as depending more on knowledge and experience in manipulations, or the labor of the hands and the use of tools, than on the exertions of the intellect.

We are glad that the new term "Dynamical Engineering" has been adopted, and think with Prof. Trowbridge that its singular appropriateness will be generally recognized.

In the address under review Prof. Trowbridge also makes some able remarks upon practical and theoretical instruction:

The practical course ignores books, and the study of the natural sciences. A boy on entering a machine shop is placed at some simple mechanical work, the use of the file, or chipping hammer, or lathe. In two or three years he may acquire experience in finishing the finer parts of machinery.

* * * * * * * * * *

If he obtains a position in the drawing or designing room of such an establishment, he may acquire a knowledge of drawing, but his time is absorbed in making tracings and working drawings under the direction of superiors who have no time to impart general instruction in the fundamental principles of the work on which he is engaged. A shop, or machinery establishment is a business establishment, not a school of instruction, and it is rather a favor to young men, to allow them the limited privileges of such information as they may acquire through their own observations and experience.

Such a course may lead to a high degree of skill and excellence in the specialties of one establishment, but even in such a case the knowledge is gained by imitation. New problems even in that specialty—which involve new forms and dimensions—are apt to be discussed and solved by reference to the nearest example or precedent.

The instances of men who have reached an enviable degree of excellence by passing the first years of their training in the workshop are regarded as exceptional, and as resulting from peculiar qualifications of industry and application.

Theoretical knowledge as well as practical is necessary in order to avoid fatal errors. The only resource of practical men who are deficient in such knowledge, in solving new problems, is an actual trial involving expense and risk. On the contrary the young man who begins by a thorough course of theoretical study takes with him into his practice written experiences, deductions, and classifications, with a knowledge of an accumulation of facts which he could not acquire in a lifetime of practice.

The questions connected with the dynamical theories of heat employed as a source of power;—the propulsion of ships by steam, the movement of heavy railway trains, the raising of water, the construction of heavy steam and water-wheel machinery for rolling mills, forges and factories—all involving the movements of heavy masses, and the overcoming of corresponding resistances—are subjects which can be successfully treated only by the most rigid applications of the principles of mechanics.

This is a branch of the profession which no amount of practice alone, can reach. Sooner or later, every one who aspires to become a consulting engineer must devote himself to the study of the laws, theories, rules, and formulæ, which constitute this science.

Strength of materials and the proportions of parts to endure the strains to which they must be subjected are also subjects for the most rigid application of theoretical knowledge.

In the course of study which a young man desiring to enter the profession of Dynamical Engineering should pursue, the art of drawing is considered as of primary importance, though not by any means the most difficult accomplishment to acquire. Next in order is a sound knowledge of pure mathematics; next the science of mechanics, both independent of and in connection with its practical applications; and lastly a thorough knowledge of chemistry, physics, and metallurgy.

The fields of usefulness open to men possessing these qualifications are extensive and increasing, and the indirect benefits to be derived from the training of men in this way to take charge of the industries of the country will be felt in the increased economy of production, and the consequent reduction of cost in all that the necessities, tastes, and luxuries of modern civilization demand.

* Inaugural Address before the Sheffield Scientific School of Yale College, delivered Oct. 5, 1870. By William P. Trowbridge, Professor of Dynamical Engineering. New Haven: Printed by Tuttle, Morehouse & Taylor.

THE MONT CENIS TUNNEL COMPLETED.

The readers of the SCIENTIFIC AMERICAN have been made familiar with the history and progress of this enterprise, which for thirteen years has been looked upon as one of the greatest of modern engineering feats; yet, at this time, a brief recapitulation will not be out of place, as telegraphic dispatches have announced the completion of the work.

It was, we believe, about the year 1830 when the tunnel was first talked of. In 1842, the king of Sardinia agitated the subject, and subsequently, under the encouragement of Count Cavour, its projectors appointed a committee of engineers to make preliminary surveys. In 1857 the work was commenced. At first, only the ordinary excavating tools—the pick, spade, and hand drill—were employed, and the work proceeded very slowly.

In 1861 a perforating machine was set to work on the Italian side, and in 1863, a similar machine was put in operation on the French side. No vertical shafts have been sunk; the work proceeded continuously from both sides till the two cuttings met. The cutting has been somewhat more rapid on the French side than on the Italian side.

The machines used were driven by compressed air, conveyed to them through tubes, and ventilation was also maintained by the aid of machinery. Gunpowder was at first used for blasting; afterwards gun-cotton was employed, and, finally, nitro-glycerin.

In 1862 the French Government agreed to defray half the estimated expense of the cutting (65,000,000 f.), in annual subsidies, provided it should be completed in twenty-five years, at the end of which time, should the tunnel remain unfinished, the French should cease to pay anything further. On the contrary, it was stipulated that if the tunnel was completed in ten years from June 30, 1863, the French should pay the full half of the estimated expenses. As the latter condition has been fulfilled, with two and one half years to spare, the French Government will now be held for its moiety.

The Mont Cenis Tunnel, which is eight miles in length, is the greatest work of its kind ever undertaken, and the success and rapidity with which it has been brought to its early termination is a triumph of engineering second to no other on record.

PAVEMENTS.

Want begets supply. When the public become dissatisfied with what they have, and are fully decided as to what is really needed, nothing is surer, in these days of scientific and mechanical progress, than that somehow, by somebody, the need will be met. The public want better pavements. The public will certainly have them. The old cobble-stone pavements, "the car rattling over the stony street," are soon to be things of the past. What is to be *the* pavement? There is no more promising or more difficult field for inventors than this. The man, or the company, who can answer the question satisfactorily, not only does the world a great service, but opens a mine of wealth. Inventors know this, and rush into the field with almost the same eagerness of competition as wealth-seekers thronged to the gold diggings of California, or to the diamond regions of South Africa. New pavements multiply upon us. "Their name is legion." Each claims to be the pavement *par excellence*, but none has, yet impressed the public as just the thing. It is not our purpose to discuss the merits of the different kinds of pavements, nor the claims which the inventors of each may put forth, but to call attention to the requisites of a perfect pavement. We have before alluded to this subject, and we return to it for the reason that those who are working in this direction seem almost invariably to lose sight of some feature indispensable to permanent success. And here a remark or two upon the word success may not be out of place. Success in making large profits through corrupt "jobbists" is one thing; a success in a mechanical, scientific, utilitarian point of view is quite another. In the former sense we have had many successes; in the latter sense, as yet, none. We do not mean to say that we have not pavements possessing some of the essentials, but we do mean to say that there has been no pavement extensively laid for which any close student of the subject will venture to predict universal use, or anything like it, say fifteen or twenty years to come.

Let us seek to enumerate the essentials, and let each inventor consider for himself whether his particular device or combination provides for or meets them.

1st. Durability. Not merely sufficient to withstand a few years' wear in some fashionable avenue, frequented for the most part only by carriages, but sufficient to justify adoption in our most thronged and roughly-used business thoroughfares. It may be claimed, with show of reason, that we may have different varieties of pavement for different localities, but it will certainly be conceded that a pavement for which streets adapted to its endurance must be selected cannot claim to be perfect.

2d. Cheapness. We mean cheapness in the true sense of the term. That is not always the cheapest which costs the least. If there is any matter in which a city may be "penny wise and pound foolish," it is just this matter of pavements. That is truly the cheapest where the purchaser gets the greatest possible return for the expenditure. Viewed with reference to durability alone, other things being considered as equal, that pavement is the cheapest with which it costs the least, interest and repairs included, to keep a street paved, and which exacts the least from teams and vehicles compelled to use it. To illustrate by an extreme: A pavement that would last forever—supposing such a thing possible—would be dear at sixteen dollars per square yard, as compared with an equally agreeable pavement, lasting eight years, at five dollars per square yard; for the interest on the difference of cost would more than renew the pavement every eight years. The pavement, no matter how good, should not exceed in cost our present improved pavements, say five or six, or at most, for the severest streets, like our Broadway, seven or eight dollars per square yard. This, of course, does not include bonuses to jobbing city officials, for a pavement possessing all the requisites would fight its own battles, and ultimately compel its own adoption, and not be under the necessity of buying its way into public favor.

3d. Permanent abundance of material. We say *permanent* abundance, for, no matter how good a pavement may be, constructed of a material the supply of which is limited, or must in a few years become so, such an one cannot be the pavement of the future.

4th. Evenness of surface. This essential hardly needs remark. The jolting, rattling, and rumbling, and wear and tear on horses and vehicles, of our present stone pavements, are nuisances no longer to be borne, and it is marvellous that they have been tolerated so long.

5th. Sure foot-hold for horses. Neither those who own horses nor those who have any sensitiveness to the sufferings of these much-abused and useful animals, will favor a pavement upon which horses are constantly slipping, straining, or falling.

6th. Noiselessness. This follows, of course, from evenness of surface, which must be combined with a certain degree of uniform roughness to meet the 5th requisite—sure foot-hold.

7th. Rapidity of construction, so that the street may be impeded for the shortest possible time. The pavement should be completed at the rate of a block, or nearly so, per day, and each block be thrown open to the public on the day following its construction.

8th. Facility of repairs. For the sake of an illustration, we have supposed a pavement lasting forever; but pavements do *not* last forever. It would seem that a pavement which could be laid with facility ought naturally to be repaired with facility; but this does not follow. Some of our improved pavements cannot be repaired without keeping the block, upon which the repairs are made, closed for days for the repaired portion to harden, and some cannot be *perfectly* repaired at all.

9th. Freedom from dust. That is, freedom from dust arising from the pavement itself, which follows naturally from durability; for dust of the pavement proper is caused by pulverization under attrition of hoofs and wheels, and if a pavement wears slowly it makes but little dust. Freedom from dust arising from droppings of animals, etc., is only attained by sweeping, and the surface should have such a kind of roughness as to be easily swept, possessing no deep crevices, or places for the permanent lodgment of filth.

10th. Dryness. There should be nothing of an absorbent nature in or about a pavement, because moisture absorbed into the pavement renders it subject to the action of frost, and, in a sanitary point of view, certain to become impregnated with impurities, making it both offensive and unhealthy.

We have purposely left out of our enumeration of requisites one frequently mentioned, and by some considered indispensable, viz: facility of taking up for the purpose of repairing or constructing sewers, gas pipes, water pipes, etc. Such facility at the present time is desirable, but for the future it is not indispensable. The subterranean work for cities will ere long conform to the pavements, and be so constructed as to be reached without disturbing them.

It would not be deemed wise to build houses with reference to digging and repairing cellars under them afterwards, and it is but a little better policy to construct streets with reference to tearing them up. We do not pretend to say what material, or combination of materials, or what device, or contrivance for using them, are to meet all the conditions which we have enumerated. The material most abundant, and thus far most extensively used, has been stone. Yet no form of stone pavement has, up to the present time, proved satisfactory. All have been either uneven and noisy, or, if smooth, so slippery as to be at times inconvenient. The most agreeable form of stone roadway extensively used is the form commonly known as the McAdam, or broken stone road. And yet a street paved with broken stone alone would not answer the purpose, for the reason that it is not impervious to water. Yet we venture to suggest—and inventors may take the suggestion for what it is worth—that if broken stone could be held together by some kind of cement of sufficient tenacity and durability to hold the stones in their places till worn out, and render the wood impervious to water, and if a pavement thus composed could be made to meet the requisites of cheapness and rapidity of construction, it would, perhaps, approach very nearly to the requirements of the coming pavement.

A VEIN of block coal, forty-seven feet in thickness, was recently discovered near Alamo, Ind. A company of Pennsylvania capitalists have, it is said, offered one million dollars for it, but have been refused.

AIR LIGHT.

What has become of the air light about which so much was said a few years ago? This light belonged to the class where an oxide is rendered incandescent, and hence powerfully luminous by the heat of a burning jet of mixed gases. Instead of using oxygen and hydrogen, it was proposed to compress illuminating gas into cylinders and to employ atmospheric air also under pressure, but previously superheated. The air contains one part, or 20 per cent, of oxygen, and four parts, or 80 per cent, of nitrogen; hence it would require four or five parts of air to give the requisite quantity of oxygen; that is, to obtain one foot of oxygen, five feet of air would be needed, as four of them would be nitrogen.

It has been proposed to remedy this difficulty by passing the air through water under pressure, and freeing it of a large part of its nitrogen, as that gas is not so soluble in water as oxygen. But this would involve expensive apparatus. If the nitrogen could be prevented from carrying away the heat from the jet at the point of ignition, the air would give us all the heat and light required when burnt in combination with illuminating gas. To prevent the nitrogen from conducting away the heat the air must be previously superheated in furnaces and fed hot to the burner. Some of the locomotives on the New York Central Railroad were at one time supplied with head-lights composed of four compound jets, encircling a small pencil of lime. A current of air and of gas was conveyed to each jet, and by a simple device the air was heated before reaching the jet. The flow of gas was controled by simple regulators and stop-cocks within the lamp. Two gas holders, placed under the engine, communicating with the lamp by a small pipe for each, were constructed to carry two or three times the requirements of a trip. The air was superheated by being passed through the fire-boxes under the boilers without additional cost. The engineer who explained it to us pronounced it a perfect success, but that was several years ago; since then we have heard nothing of it, and so repeat the question: What has become of the air light?

WASTE LIQUORS OF PAPER MILLS.

The American Wood Paper Company at Manayunk, Penn., have introduced an important feature into their works in saving the waste alkali solutions. It is said that eighty-five per cent of the original alkali employed is recovered. The spent liquor is conducted from the pulp boiler into a suitable reservoir, where it is pumped up into evaporating furnaces. These furnaces are constructed according to a patent granted to Messrs. Keen & Burgess in 1865. They are of great length and radiate from the center of a building resembling a locomotive shed, and all communicate with one central chimney. A powerful draft carries the hot gases of combustion over and under the evaporating pans, and the water is thus rapidly carried off. The alkali is finally transferred to the calcining furnaces, where it is brought to a condition suitable for mixing with a fresh portion, preparatory to being used again. In the manufacture of paper from straw the stock is also boiled in caustic soda lye under pressure, and in most establishments the impure black liquor is thrown away. The soda extracts silica and gluten from the straw, and thus forms a very weak and impure soluble glass. It has been proposed by some manufacturers to evaporate the solution and economize the soluble glass and the extra alkali, but the expense of the evaporation has deterred most of the larger establishments from attempting to make the saving. It would be well for such paper manufacturers as deal in large quantities of alkali, to try the Manayunk process described above. If soda were a substance that could be thrown down from a solution by precipitation, it would be an easy matter to save it, but unfortunately there is no reagent with which it can be combined for this purpose, and we are compelled to have recourse to evaporation. The use of the spent alkali for agricultural purposes has been tried, and if potash had been employed instead of soda the results would be favorable where the expense of transportation did not destroy all the profit, but as soda is now considered by many authorities as actually deleterious to the growth of plants, this application of the spent alkali of the paper mills cannot be recommended. The soluble silica would be of great value in agriculture if it could be separated from the alkali, but this separation is not feasible. There is no reason why the lime used in the vats to render the soda ash caustic should not be put upon land, and such a disposition of it is made at many country mills.

If any of our readers can give us additional information on this subject we shall be glad to make room for their communications.

SPIRITUALISM AND SCIENCE.

Two of our correspondents exhibit a commendable desire for information in reference to the movements of tables by invisible spirits, and as one of them appears to have been severely handled by some of the evil kind, we do not wonder that he seeks for an explanation of the phenomenon.

If there is anything established in nature, it is the invariableness of her laws. The laws which regulate the material world are beyond all reach, and the Creator never permits the management of the universe to pass out of his own hands, or to be interfered with by any of his creatures. The moment we deny this, that moment science becomes impossible. For ages the belief obtained that angels and demons were able to control or influence physical laws. As long as such superstition prevailed, scientific progress was impossible. It was only when it was discovered that the laws of the physical universe were fixed and sure that men were encouraged to carry on scientific research, for they then knew for the first time that if they asked for bread they would not receive a stone.

The physicist now knows that to move a table without the aid of muscular or mechanical force requires a suspension of the law of gravitation, and he also knows that the momentary suspension of this law would reduce the whole universe to chaos and destroy the equilibrium of matter. To suppose that any spirits have such power as this is impious and irreverent in the extreme. None but the Divine Spirit can act on matter except through the medium of matter, and to ascribe such power to any of God's creatures, whether in the flesh or out of the flesh, overthrows all that religion and science have taught us. Hence the scientific man never believes in any apparent infraction of the laws of the universe. He knows that the phenomenon observed is due to natural causes, and goes to work to search out the mystery. There are plenty of known causes which have always been in operation, that are quite sufficient to produce all of the genuine results of spiritual manifestation without the necessity of appealing to the supernatural for an explanation, and Dr. Hammond has shown us that there are other causes which explain why honest people may conscientiously believe in the genuineness of all these manifestations.

We have recently given a series of articles on the history of attempts to invent a perpetual motion. The physicist is absolutely certain that a perpetual motion *accomplishing work* is an impossibility according to the known laws of mechanics, yet the attempt to construct such a machine has been made for centuries, and no doubt will continue to be made as long as the world stands.

If a party of true believers in spiritualistic manifestations could seat themselves by the side of a stream of water and make it run up hill, they would accomplish a much more clever trick than to chase a table up stairs or out of the window, as your genuine spiritualist will not hesitate to do for you at any time; but as it is difficult to take hold of the particles of a liquid, this particular form of exhibition is never attempted, and making water run up hill is chiefly confined to a vulgar force pump.

Many of our readers have no doubt witnessed the performances of necromancers, and have gone home greatly puzzled and wholly unable to explain what they had seen. We recollect to have seen a cane set upright on a floor and a lad balanced horizontally upon it. There was nothing particularly wonderful about this, but when the cane was taken away, without the lad's falling, and it was passed over, and under, and all about him, so as to show that he was not supported by wires from the ceiling or by rods from the floor, we had no ready way for accounting for it, but were absolutely certain, from our knowledge of the fixity of all physical laws, that there was some trick by which it was done, not visible to the senses. Aristotle believed that the heavenly bodies were suspended by invisible cords, otherwise they would fall upon the earth and crush it. He was evidently no spiritualist, but a believer in the necessity of something tangible to hold up the stars.

Some of our correspondents complain that scientific men will not examine into the phenomena of table-turning and give us an explanation upon a physical basis. They forget that this has been done by the highest authorities in this country and Europe.

In 1859, in the city of Boston, a reward of five hundred dollars was offered, through the columns of the *Courier*, for a satisfactory exhibition of some of the ordinary manifestations which mediums of every degree were constantly pretending to produce and which were fully believed in by the faithful as of spiritual origin. The challenge was accepted by a spiritual corps consisting of Dr. H. F. Gardner, Mr. Allen Putnam, Mr. Alvin Adams, Major Raines, Miss Kate Fox, and others, and Professors Peirce, Agassiz, Horsford, and Dr. B. A. Gould, were appointed a committee to give them a fair trial. It is hardly necessary to say that the whole thing was an utter and complete failure, although the distinguished professors displayed the utmost candor and patience in their search for the truth, just as they would have done in any other scientific investigation.

In England the late lamented Professor Faraday subjected the phenomena of table-turning to a most searching investigation. The report of his experiments has been extensively published and ought to be regarded as conclusive by the most skeptical inquirer. Our readers will find it in *The Athenæum*, page 801, for the year 1853.

Professor Faraday by an ingenious device found a way of measuring the direction of the force by which the table was moved and showed that the movement of the muscles was involuntary. Whenever an index was attached to the table which made the least motion visible to all, there was no effect, because the involuntary feature was destroyed and the parties to the transaction could not exert the force required for lifting it excepting in the ordinary way, and such table lifting would be like moving furniture about the room in the most humdrum style. The experiments were a perfect demonstration of the muscular origin of the table moving, and must be admitted as such by any one possessed of sufficient capacity to understand them.

There is no doubt that rappings and tippings were known to the Romans, and they were re-discovered, so far as this country was concerned, at Rochester, in 1846. Since that date we have had a surfeit of them, and it has now become a regular business, as much so as selling groceries or giving exhibitions with the magic lantern. The tricks of the trade have been exposed over and over again, but the world will be deceived by them in spite of all the warnings that we or the daily papers can give. We must look to our schools to correct the evil by the dissemination of accurate scientific information among the people.

ALLOY OF LEAD AND PLATINUM.

Most beginners in the laboratory have involuntarily made an alloy of platinum and lead by attempting to fuse lead in a platinum crucible, and finding to their dismay the bottom falling out.

Professor Bauer has subjected the alloy to a scientific investigation. He prepared an alloy by fusing three parts of lead and one part of platinum, which was so brittle that it could easily be pulverized in an agate mortar. This was moistened and exposed to the action of carbonic acid until a considerable portion of the lead was converted into the white carbonate, and there was no longer any action.

The residual alloy from this experiment was subjected to analysis, and yielded:

	Analysis.	Calculated.
Platinum	45·86	48·82
Lead	50·97	51·18
	99·83	100·00

This would give the formula P + Pb. The alloy of platinum and lead prepared in this way is a crystalline, brilliant, steel-gray powder, which is easily decomposed by mineral acids, but remains unchanged in dilute acetic acid. When heated it fuses easily to a brittle crystalline mass, resembling bismuth. Heated in a current of air the lead oxidizes, and can therefore be removed in a muffle.

The specific gravity of the alloy is 15·77 by calculation; it ought to be 16·15. This method of preparing the alloy of lead and platinum may have application with other metals, and Professor Bauer is now occupied with that branch of the subject. It has been hitherto supposed that an alloy of lead and platinum could not be kept any length of time without changing into white lead and platinum powder. The new researches show that a permanent alloy can be made in the way above indicated.

PLANTS of the cactus family are principally confined to the Western continent, and although most abundant in tropical regions, some forms extend far into the temperate zone, and some species even have an alpine character. Back, in his northern expedition, saw with astonishment the banks of the Rainy Lake, in latitnde 40° 40', entirely covered with the prickly pear (*Opuntia vulgaris*). Humboldt found on the Andes several species of cactus on elevated plains from 9,000 to upwards of 10,600 feet above the level of the sea. Some have even been gathered at an elevation of 13,600 feet. In size and hight the different kinds present remarkable contrast. In Mexico and Arizona many kinds assume an arborescent form. Other kinds have a globular form, some with a dia meter of three feet, and attaining a weight of 2,000 pounds while a cactus in South America is so small and so loosely rooted in the sand that it gets between the toes of dogs.—*Entomologist.*

STUDY OF NATURAL HISTORY.—For many years it has been one of my constant regrets that no schoolmaster of mine had a knowledge of natural history, so far at least as to have taught me the grasses that grow by the wayside, and the little winged and wingless neighbors that are continually meeting me with a salutation which I cannot answer, as things are. Why didn't somebody teach me the constellations too, and make me at home in the starry heavens, which are always overhead, and which I don't half know to this day? I love to prophesy that there will come a time when, not in Edinburgh only, but in all Scottish and European towns and villages, the schoolmaster will be strictly required to possess these two capabilities (neither Greek nor Latin more strict), and that no ingenious little denizen of this universe be thenceforward debarred from his right of liberty in those two departments, and doomed to look on them as if across grated fences all his life!"—*Carlyle, in the Edinburgh Courant.*

THE arborescent grasses constitute one of the most beautiful adornments of tropical vegetation. These grasses belong chiefly to the *Bambusa* (bamboo) and other related genera. In India the seeds of the bamboo are mixed with honey and eaten like rice. In South America an arborescent grass, the gigantic *Guadua*, attains a hight from 50 to 60 feet. Another species, a powerful climbing grass, twines around the trunks of large trees, reaching to their tops. A species of cane (*Arundinaria*) grows in large tufts, reaching a hight of 30 to 40 feet, of which the first joint rises without a knot to a hight of 16 feet before it begins to bear leaves. These joints being hollow, are used as blowing tubes by the Indians, for the discharge of their arrows. Even in the Southern United States the stalks of *Arundinaria* furnish fishing rods of the best description.

A SAN FRANCISCO undertaker claims to have discovered a new method of preserving the dead human body. By his process he petrifies it. He exhibits a body that he petrified in July, 1868, and it shows no signs of decay. When struck, says the editor of the *Morning Call*, it gives out "a ringing, metallic sound." The color of the flesh is not changed. All this is very wonderful, if true, but it is of questionable utility so far as the human body is concerned.

BELGIAN RAILS.—In the first eight months of this year Belgian rails were exported to the extent of 93,889 tuns, against 103,746 tuns in the corresponding period of 1869. There was a considerable increase in the exports of Belgian rails to the Zollverein, France, and Spain, but a decrease occurred in the exports to Russia, the Low Countries, Turkey, Italy, and the United States.

SCIENTIFIC AMERICAN.

1871.

Special Club Premium.

A New Volume of this journal commences on the first of January. Any person sending us yearly clubs for ten or more copies will be entitled to receive, free of postage or express charge, one copy of the celebrated engraving, "MEN OF PROGRESS," for every ten names.

This large and splendid Steel Plate Engraving is one of the finest art works of the day, possessing a rare and peculiar value over ordinary pictures, by reason of the life-like accuracy of the personages it represents. The scene of the picture is laid in the great hall of the Patent Office, at Washington. The grouping is spirited and artistic. Among the persons represented are the following eminent inventors:

S. F. B. MORSE, ... Inventor of Electric Telegraph.
CYRUS H. McCORMICK, ... Inventor of Reaper.
THOS. BLANCHARD, ... Inventor of Lathe for Irregular Forms.
WILLIAM T. G. MORTON, ... Inventor of Chloroform.
SAMUEL COLT, ... Inventor of Revolving Fire-Arms.
CHARLES GOODYEAR, ... Inventor of Rubber Fabrics.
FREDERICK E. SICKLES, ... Inventor of Steam Cut-Off.
HENRY BURDEN, ... Inventor of Horse-Shoe Machine.
JOHN ERICSSON, ... Inventor of the first Monitor.
JAMES BOGARDUS, ... Inventor of Iron Buildings.
JOSEPH SAXTON, ... Inventor of Watch Machinery.
PETER COOPER, ... Inventor of Iron-Rolling Machinery.
JOSEPH HENRY, ... Inventor of Electro-Magnetic Machine.
ISAIAH JENNINGS, ... Inventor of Friction Matches.
RICHARD M. HOE, ... Inventor of Fast Printing-Presses

These noble men, by their own efforts, raised themselves from the depths of poverty, and by their wonderful discoveries, conferred incalculable benefits upon the human race, entitling them to rank among its greatest benefactors. It is but fitting that the remembrance of their achievements, and the honored forms of their persons, as they lived and walked among us, should be perpetuated by the highest skill of art. The picture, which is three feet long and two feet high, forms an enduring and desirable object for the adornment of the parlor. It was engraved by the celebrated JOHN SARTAIN, from a large painting by SCHUSSELE, and all the portraits were taken from life. Every lover of Science and Progress should enjoy its possession. Single copies of the Engraving $9; Three copies, $25.

One copy of the SCIENTIFIC AMERICAN for one year, and a copy of the Engraving, will be sent to any address on receipt of $10.

MUNN & CO.,
37 Park Row, New York City.

Queries.

[*We present herewith a series of inquiries embracing a variety of topics of greater or less general interest. The questions are simple, it is true, but we prefer to elicit practical answers from our readers, and hope to be able to make this column of inquiries and answers a popular and useful feature of the paper.*]

1.—WHITE VARNISH FOR PAPER.—I wish a recipe for a white varnish for heavy paper that is white when applied, and will remain white after it is applied, and dry perfectly hard in a week after application.—J. D. B.

2.—CEMENT.—I wish a recipe for a cement to fasten chamois and other leather to iron and steel.—F. P. B.

3.—BLUEING PISTOL BARRELS.—I can form a blue on iron or steel by heat, but I am told the beautiful blue color on fine pistols is produced by acids and not by heat. Will some one inform me of the true method employed?

4.—PAINT FOR GALVANIZED IRON.—What is the best paint for priming galvanized iron so as to make a durable job?

5.—MAGNETIC PROBLEM.—Suppose two iron plates or disks of definite size to be placed one eighth of an inch apart, and then to be connected with battery poles, so as powerfully to attract each other. If now one of the plates be made to revolve at definite speed, will the attraction be diminished, and if so in what ratio to the size and speed of revolution of the plates?

6.—TO EXTRACT OIL FROM OLD BELTING.—How can I extract the oil from old belting, particularly sewing machine belts, so that they can be used again?—C. W. L.

7.—WHITENING DIALS OF STEAM GAGES.—How are the dials of steam gages and the scales of barometers whitened so as to present their peculiar frosted appearance?—M. C. H.

8.—TEMPERING JEWELERS' TOOLS.—How can I temper jewelers' tools, such as drills, small engravers, etc.? What color should they be when tempered? Also I wish the name of some instructive work on jewelling.

9.—CEMENT—GALVANIZING CAST IRON.—Will any of your million readers tell me how to make a cement that, when hard, looks like cast iron filed, and which will stand a moderate degree of heat? I would also like to ask of some one posted how to galvanize a deeply corrugated cast-iron surface which is not very large or cumbersome, the main point being to put it on very smoothly, and whether the piece to receive the coat is to be first heated?—M. H. K.

10.—SUBSTITUTE FOR PAPER.—What article can be obtained which can be written and printed upon and rolled up like paper, but stronger, and which can be had of indefinite length?—G. B.

11.—RENDERING BRICK FLOORS IMPERVIOUS TO MOISTURE.—The floor of the lower story of my house is laid in brick with a thick coat of Rosendale cement which is not impervious to moisture. What is the most economical way of preventing dampness from coming through and rotting the carpets?—J. M. K.

12.—PASTE.—What is the best recipe for paste to firmly attach strips of cotton cloth to stiff colored paper without leaving the parts pasted together much more rigid than the paper itself?—J. W.

13.—MILLSTONES FOR GRINDING CORN AND FEED.—Will some of your millwright readers inform me what sized burrs, kind, etc., shall I purchase for grinding corn and feed? I have a 10-horse power engine, and wish a mill that will suit such power. Are any of the patent mills or iron mills any improvement upon the old-fashioned French burrs?

Business and Personal

The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, One Dollar and a Half per Line will be charged.

Answers to Correspondents.

CORRESPONDENTS who expect to receive answers to their letters must, in all cases, sign their names. We have a right to know those who seek information from us; besides, as sometimes happens, we may prefer to address correspondents by mail.

SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however, when paid for as advertisements at 1'00 a line, under the head of "Business and Personal."

All reference to back numbers must be by volume and page.

Soldering Spring Wire.—J. E. W. asks how to solder spring wire with hard solder. In watch making I have often made brass and steel tongues, soldered them to the joint with hard solder, and left them in an elastic state. Steel wire may be tempered in the usual manner after soldering, but we usually treat it the same as brass. After soldering the temper is restored by hard rubbing with a burnisher, which condenses and hardens the wire in the same way that hammering or milling does a plate. Brass, gold, copper, or silver, should be treated with dilute oil of vitriol after soldering, to destroy the oxide and the compound of oxide with borax or other flux used. Steel or iron should never be put into vitriol.—J. T. L., of S. C.

Heating Surface of Steam Boilers.—W. V. B. is running an engine developing, according to his statement, 107-horse power, while his locomotive boiler, allowing 6 square feet of heating surface per horse-power, develops only 50-horse power. Two cylinder boilers, 30 inches diameter and 40 feet long have 323¼ feet of heating surface; and as a much greater proportion of fire surface is required per horse-power in a cylinder boiler than in a locomotive boiler, the two cylinder boilers would not generate steam faster, perhaps not as fast as through the locomotive boiler, and therefore could not supply steam enough to run the engine under the conditions specified.—W. M. M., of Mich.

Boiler Capacity.—If the two cylindric boilers referred to by W. V. B., be well set and covered in, say 6 inches above their centers, they will present 400 square inches of surface to the fire, and ought to give 40 to 45-horse power of steam to the engine mentioned, if the steam be properly utilized in the cylinder. We have obtained 55-horse power with a 15 x 36-inch cylinder, with plain slide valve, the steam being made in three 36-inch diam., 20 feet plain cylinder boilers fired with shavings and sawdust. The difficulty with the locomotive boiler is lack of effective heating surface. Not more than half the surface of the tubes, owing to soot and ashes, being available for transmission of heat.—J. H. C., of Pa.

Wire of Solder.—E. E. D. can make solder in the form of wire, as follows: Take a common ladle used for melting lead, and drill a small hole one half inch from the brim opposite the nose. Melt the solder so that it will run easy through the hole, and as it runs out, draw the ladle along over some smooth surface, such as a saw plate or the face of an anvil. If done properly it will run in the shape of a thin wire as long as the surface you run it on. This is the only way I think it can be done. The right of making solder wire this way was purchased from a peddler, who went round the country selling the wire to jewelers.—C. H. G., of N. Y.

Calculating Heating Surface of Tubes.—W. V. B. should calculate the heating surface of tubes from the inside.—G. M. M., of N. J.

L. J. K., of N. Y.—The conventional tints for the various materials represented in mechanical drafting are variously prepared. We prefer Johnson's formulæ to any other. According to these formulæ, stone is represented by a light dull yellow, made by mixing a little India ink with Roman ochre. For brick use a light red, made of vermilion, brightened by a little carmine. For steel or wrought iron a light shade of Prussian blue, a trifle lighter for steel than wrought iron. For cast iron use indigo, with a little carmine added, or Payne's gray. For lead and tin use the same color as for cast iron, with the addition of a small proportion of India ink and carmine. For copper, use pure carmine or crimson lake, with a little burnt sienna added. For brass or bronze use burnt ochre or a mixture of gamboge with vermilion, or simple gamboge. If the mixture of gamboge and vermilion be used, it must be kept constantly stirred, or the colors will separate. For wood use burnt umber, or raw sienna. For leather use a light tint of sepia; for gutta-percha a darker tint of the same, and for vulcanized rubber, use sepia with a little indigo added.

A. H., of Ohio.—The word power is used in two senses. In the modern use of the term it means the ability to perform work as measured by foot-pounds of resistance overcome in a definite time. In this sense the term is general in its signification, and has no reference to any particular resistance to be overcome. It is in this sense, doubtless, that Mr. Craik uses the word in the article on "Fly and Balance Wheels," published on page 403 last volume, and to which you take exception. In the old saying, "What is lost in speed is gained in power," and *vice versa*, the word power is used in a special sense, meaning ability to overcome a particular resistance, as, for instance, a particular weight to be raised in mass. Mr. Craik makes no claim in his work to literary merit, and perhaps fails to express himself perfectly in the passage cited. We understand, however, his meaning to be what we have stated, the expression "loss in power" probably referring to consumption of power through friction, etc.

L. I. O., of Minn.—From your description we judge your ice-house leaks air at the bottom, either through the drain pipe, (is there a trap in this pipe?) or through unstopped crevices. Such crevices would cause a downward draft of warm air through the open ventilator at the top, and cause the melting from the top and sides of the ice of which you complain. If you must use an open ventilator at the top to keep the articles stored in good condition, you must be careful to stop all the air holes at the bottom.

A. B. S., of Pa.—The simplest and most common way of making U-magnets, is to forge the steel bars into the proper shape, harden, and then place them with their poles together, in such a way that the poles which are to be of opposite names shall come together. They are then rubbed with a strong horseshoe, or U-magnet, placing the latter in such a way that its north pole is next to the south pole of one of the new magnets, and its south pole next to the north pole of the same new magnet.

J. D. O. C.—It is not necessary that drawings intended to illustrate a work on carpentry should be as finely executed in the manuscript as they are intended to appear in the work itself. The artist, if he knows his business, will be able to execute them properly, provided they are intelligible.

J. T. L., of S. C.—Your query in regard to weights and cords is not sufficiently explicit. Do you mean a cord attached at both ends, or only at one end?

J. G. M., of ——.—There is no known solvent for the diamond. Evaporation is a widely different process from dissolving. Consult your dictionary on the meaning of these terms.

C. H. S., of ——.—In the absence of our regular proof reader last week, an error occurred in the answer to your query. It should have read: The Torricellian Vacuum, formed by inverting a tube filled with mercury in a cup containing the same metal, is not perfect. Good authorities maintain that no perfect vacuum can be produced.

J. S., of R. I.—For siliceous silica, in the answer to your query published last week, read *infusorial* silica.

T. T. O., of Ill.—For rules to calculate dimensions of safety valve, lever, etc., consult Bourne's Hand Book of the Steam Engine. Any bookseller will order it for you.

A. H. L., of Mass.—There is no substance known which, placed between a magnet and its armature, will stop its attraction.

B. F. C., of R. I.—Your method of making leather handles is not new.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

PROVISIONAL PROTECTION FOR SIX MONTHS.

2,905.—Pneumatic Telegraph.—Edward A. Calahan, Brooklyn, and G. B. Baker, New York city. November 3, 1870.

2,924.—Buoyant Mattress Designed to Serve either as a Bed or a Life Preserver.—Joshua Hunt, Providence, R. I. November 5, 1870.

2,925.—Axles of Railway and Tramway Carriages, and in Apparatus to be Employed therewith.—Henry Graham Thompson, New York city November 5, 1870.

2,931.—Tell-tale Mechanism Applicable to Clocks and Watches.—Cyrille Duquet, Quebec, Canada. November 21, 1870.

2,934.—Machine for Cutting and Printing Lozenges and Crackers.—Ernest Greenfield and Philipp Strauss, New York city. November 7, 1870.

2,935.—Metallic Composition for Roofing Linings, Pipes, and other Purposes.—David J. Millard, Clayville, N. Y. November 7, 1870.

2,936.—Improvement Applicable to Treadles used in Sewing and other Machines.—Charles Gordon Patterson, New York city. November 7, 1870.

2,939.—Machinery for Manufacturing Carpet Lining.—Joel F. Fales, Walpole, Mass. November 9, 1870.

2,943.—Process for Extracting the Useful Substances of Hops, and for Manufacturing a Pure and Concentrated Extract of Hops.—C. A. Seely, New York city. November 8, 1870.

2,950.—Method of Securing or Locking Screw Bolts and Nuts.—Robinson Rutter, Vallejo, Cal. November 9, 1870.

2,953.—Sewing Machines and Tables for Sewing Machines.—J. N. Tarbox, Hamilton, Canada. November 9, 1870.

2,951.—Apparatus for Effecting and Regulating the Supply of the Deodorizing Material in Earth Closets.—William R. C. Clark, Chicago, Ill., and James E. Aiken, New Orleans, La. November 9, 1870.

2,969.—Manufacture of Alkalized Isinglass, Sulphited and Bisulphited.—Baylis Child, New York city. Nov. 11, 1870.

2,978.—Penholder and Pens.—Isaac Jacobs, New York city. November 12, 1870.

APPLICATIONS FOR EXTENSION OF PATENTS.

Machine for Cutting Pasteboard for Boxes.—Franklin N. Clarke, New Haven, Conn., has petitioned for an extension of the above patent. Day of hearing Feb. 15, 1871.

Enema Syringe.—Herman E. Davidson, Gloucester, Mass., has petitioned for an extension of the above patent. Day of hearing March 15, 1871,

Seeding Machine.—L. B. Myers and H. A. Myers, Elmore, Ohio., have petitioned for an extension of the above patent. Day of hearing Feb. 15, 1871.

Casting Skeins for Wagons.—John Benedict, Kenosha, Wis., has petitioned for an extension of the above patent. Day of hearing Feb. 8, 1871.

Enema-giving Apparatus.—Benjamin T. Babbitt, New York city, has petitioned for an extension of the above patent. Day of hearing March 1, 1871.

Gas Generators.—Alonzo M. Giles, Boston, Mass., has petitioned for an extension of the above patent. Day of hearing March 1, 1871.

Chairs for Invalids.—James G. Holmes, Charleston, S. C., has petitioned for an extension of the above patent. Day of hearing May 21, 1871.

Machine for Cutting and Bending Sheet Metal.—Elliot Savage, West Meriden, Conn., has petitioned for an extension of the above patent. Day of hearing March 1, 1871.

Recent American and Foreign Patents.

Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.

Composition for Destroying Worms in the Cotton Plant.—Thoma W. Mitchell, Richmond, Texas.—The object of this invention is accomplished by sprinkling the cotton plants, on which the worm feeds, with a solution of arsenic in water, in suitable proportions.

"Middlings" Purifier.—Lemuel G. Binkly, Baughman, Ohio.—This invention relates to an arrangement of reels, one of which is covered with coarse cloth for separating and removing the coarse feed and shorts, the fine feed, middlings, and flour being thence conveyed to another reel covered with finer cloth. The middlings and fine feed are by this last separated from the flour, and conveyed to a chamber over the reels where a fan and hinged deflectors quickly separate them into three grades, and distributes them in hoppers or bins correspondingly.

Plow.—Arthur C. Smith, Joyner's Depot, N. C.—This invention has for its object to improve the construction of turn-plows to better adapt them for running the first furrows in breaking up the land and forming the ridges in preparing the land for planting cotton.

Spice Boxes.—Edward S. Kennedy, Birmingham (Buchanan Postoffice), Pa.—This invention has for its object to furnish an improved spice box, which shall be so constructed as to contain salt and pepper, or two other spices, and which shall, at the same time, be simple in construction and convenient in use.

Flour Bolts.—Cyrus T. Hanna, Keokuk, Iowa.—This invention has for its object to furnish an improved flour bolt, which shall be so constructed that the bolt cloth may be secured to the inner sides of the ribs, forming a smooth surface of bolting cloth.

Cotton Cultivator, Scraper, and Chopper.—J. H. W. Young, Henderson, Texas.—This invention relates to certain improvements in a machine or cultivating cotton, the same consisting in barring-off plows placed in such position in front of the wheels, on which the machine runs, to make tracks in the earth for the wheels to follow in; also in shanks for the scrapers pivoted at their upper ends to the frame, and provided with curved slots through which pass bolts so as to enable the scraper sto be set at different angles, according to the nature of the soil through which they run; and in chopping hoes made adjustable for the purpose of varying their position according to the desired width of hill or ridge.

Cotton and Hay Press.—S. K. Davis, Monticello, S. C.—This invention relates to improvements in the cotton and hay press patented September 28, 1869. The invention consists in providing two uprights with beveled joints and catches, which also act as supports, so as to permit a portion of the frame above the joints to be drawn from a perpendicular to an inclined position, and replaced at pleasure; also in constructing a nut with adjustable levers, and a groove for the reception of band or cord, by which the nut at each end of the press may be screwed down or up at the same time; also in the construction of a clamp provided with a hinge in such a manner that the clamp may be easily removed from the press when the bale has been formed.

Subsoil Plow.—T. G. Wilder, Camden, Mo.—This invention has for its object to improve the construction of subsoil plows, so as to make them stronger, more substantial, and easier upon the team, and enables them to be conveniently adjusted to work deeper or shallower in the ground, as may be desired, and which will cause them when adjusted to work at a uniform depth.

Propelling Apparatus for Street Cars.—John Roy, New Orleans, La.—This invention relates to improvements in apparatus for propelling street cars by means of a traction rope worked along the track, either above or under the ground, by means of stationary engines or other power, and consists in the application to the car, either at one or both sides, or between the sides, of traction wheels, preferably three in a row, so arranged that the rope will work under the two end wheels, to be prevented from rising above the ground either in front or rear of the car and over the center wheel, so as to impart rotary motion to them, which, being arrested by brakes, will cause the car to be drawn along by the friction of the rope on the wheels.

Balanced Slide Valves.—John Nesbitt, Concord, N. H.—This invention relates to improvements in balanced slide valves, or those which are so arranged that they cannot be raised off their seats when the throttle valve is closed and the piston continues in motion by the air, for admitting it behind the piston and preventing the forming of a vacuum, which greatly retards the motion, especially in the case of a locomotive going on a downward incline.

THUMB SUPPORTER.—James S. Borden, Bloomfield, Ill.—The object of this nvention is to provide convenient and efficient means for supporting and protecting the thumb of the hand in the operation of binding grain.

PORTABLE FARE BOX.—Alfred Bradley, New Orleans, La.—This invention has for its object to furnish an improved fare box for the conductor or collector to carry around when collecting fares, and which shall be so constructed that the fare cannot be extracted or removed by any one but the person having the key of the box.

MEDICAL COMPOUND.—N. Jenkins, New Orleans, La.—The object of this invention is to provide a simple, safe, and effectual remedy for rheumatism, gout, neuralgia, and kindred diseases.

SELF-ADJUSTING BARREL HANDLES.—Minot S. Schofield, Stamford, Conn. —This invention has for its object to furnish handles, which shall be so constructed as to adjust themselves to barrels, boxes, and other packages, to enable the said barrels, boxes, or packages to be conveniently handled.

BAG HOLDER.—A. D. Swogger, Worth, Pa.—This invention relates to a new bag holder, which is made vertically extensible, so that it can be used to fill bags of different lengths. The invention consists in making the frame of the holder extensible, and in providing pawls or catches for locking it at suitable lengths.

HORSE-COLLAR PADS.—Jas. F. Walsh, Hazel Green, Wis.—This invention relates to improvements in the construction of sweat pads for horse collars, and it consists of two broad pieces of leather, of the proper form to fit the breast and neck of the horse, with stiffening plates of iron stitched between them to keep them smooth, the inner piece being broader than the outer one, and the inner edge of it turned outward to prevent galling the neck, and held by short straps attached to the outer piece.

VINE AND WEED CUTTER.—Harry Lawrence, New York city.—This invention relates to improvements in apparatus for removing the vines of potatoes, weeds, and the like, in advance of the potato-digging machines, and it consists in a pair of forked gathering blades, a discharging trough, and a rotary cutter, mounted on a truck, or it may be on the potato-digging machine, for gathering, cutting, and discharging the vines and weeds.

POTATO DIGGER.—William Tripp, Mechanicsville, N. Y.—This invention relates to improvements in potato diggers, and consists of a peculiar construction of one-sided shovel-shaped, and plow-shaped diggers.

THREAD TAKE-UP.—Walter Bennett, Springfield, Ill.—This invention relates to improvements in thread take-up apparatus for sewing machines, and consists in improvements in the arrangement in that class of such apparatus, designed for varying the slack of the thread according to the thickness of the cloth.

NON-CONDUCTING COMPOSITION.—John Hessing, Paterson, N. J.—This invention relates to a new and improved non-heat conducting compound, suitable for covering marine, locomotive, stationary, and other steam boilers, cylinders, pipes, etc.

KNITTING MACHINE.—John Lee, Mark Lee, and William Carter, Needham, Mass.—This invention relates to improvements in knitting machines, and consists in a combination with a knitting machine, of a shifting receiver and holder and automatic operating devices therefor, for carrying yarns of different colors and changing them to be run in with the fabric, according to any required order or pattern. The invention also consists in certain improvements in the arrangements of the operating and adjusting devices of the knitting apparatus.

PRESS.—M. G. Cunningham, Corsecana, Texas. This invention relates to mprovements in presses for hay, cotton, and other like substances, and consists in an improved arrangement of means for working the follower by a screw.

SHIP'S WINDLASS.—Enos Waterbury and G. N. Waterbury, Stamford, Conn.—This invention has for its object to improve the construction of a ship's windlass in such a way as to make it more convenient in use, it being so constructed as to allow the cable to be payed out freely, and which shall, at the same time, be simple in construction and easily operated and controlled.

Official List of Patents.

ISSUED BY THE U. S. PATENT OFFICE.

FOR THE WEEK ENDING DEC. 27, 1870.

Reported Officially for the Scientific American.

SCHEDULE OF PATENT FEES.

On each Caveat	$10
On each Trade-Mark	$25
On filing each application for a Patent, (seventeen years)	$15
On issuing each original Patent	$20
On appeal to Examiners-in-Chief	$10
On appeal to Commissioner of Patents	$20
On application for Reissue	$30
On application for Extension of Patent	$50
On granting the Extension	$50
On filing a Disclaimer	$10
On an application for Design (three and a half years)	$10
On an application for Design (seven years)	$15
On an application for Design (fourteen years)	$30

For Copy of Claim of any Patent issued within 30 years $1

A sketch from the model or drawing, relating to such portion of a machine as the Claim covers, from .... $1 *upward, but usually at the price above-named.*

The full Specification of any patent issued since Nov. 20, 1866, *at which time the Patent Office commenced printing them* .... $1·25

Official Copies of Drawings of any patent issued since 1836, we can supply at a reasonable cost, the price depending upon the amount of labor involved and the number of views.

Full information, as to price of drawings, in each case, may be had by addressing

MUNN & CO.,
Patent Solicitors, 37 Park Row, New York.

110,414.—APPARATUS FOR SUPPLYING AIR.—Henry W. Adams, Philadelphia, Pa.
110,415.—WOOD-SPLITTING MACHINE.—William A. Allen, Baltimore, Md.
110,416.—RAILROAD-CAR VENTILATOR.—George B. Armstrong, Chicago, Ill., and George F. McLellan, Washington, D.C.
110,417.—PLOW.—James Archer, Springfield, Wis.
110,418.—MACHINE FOR BURRING WOOL ON THE SKIN.—Edward H. Ashcroft, Lynn, Mass.
110,419.—CULTIVATOR.—Robert H. Avery, Galesburg, Ill.
110,420.—COFFEE-POT STRAINER.—George A. Barron, Pembroke, Me.
110,421.—BOTTLE FASTENING.—Benjamin Bates, Baltimore, Md.
110,422.—COUPLINGS FOR SHAFTING.—Charles Bean (assignor to Albert F. Allen), Providence, R.I.
110,423.—MEDICAL BITTERS.—Theodore Beck, Omaha, Nebraska.
110,424.—TAKE-UP MECHANISM FOR SEWING MACHINES.—Walter Bennett, Springfield, Ill.
110,425.—MIDDLINGS PURIFIER.—Lemuel G. Binkley, Baughman, Ohio.
110,426.—THUMB SUPPORTER.—James Sandford Borden, Bloomfield, Ill.
110,427.—METHOD OF PRODUCING ILLUMINATING GAS.—John F. Boynton, Syracuse, N.Y.
110,428.—PORTABLE FARE BOX.—Alfred Bradley (assignor to himself and W. L. Cushing), New Orleans, La.
110,429.—CHURN DASHER.—Robert Brown, Columbus, Miss.
110,430.—SAW TEETH.—Isaiah Byrd and Turner Byrd, Jr., Calvin Township, Mich. Antedated Dec. 9, 1870.
110,431.—WIRE FOR MAKING PEGS FOR BOOTS AND SHOES.—Duncan H. Campbell, Sunderland, Scotland, and Erastus Woodward, Charlestown, Mass.
110,432.—LUBRICATING COMPOUND FOR STEAM AND OTHER PACKING.—William M. Canfield, Philadelphia, Pa.
110,433.—BOOTJACK AND DOOR BUFFER.—Walter S. Chatham (assignor to John W. Riddell), Williamsport, Pa. Antedated Dec. 15, 1870.
110,434.—UMBRELLA HOLDER.—Almon Clarke (assignor of one half his right to Charles A. Spencer), Sheboygan Falls, Wis.
110,435.—ASTRONOMICAL LANTERN.—James Freeman Clarke West Roxbury, Mass.
110,436.—TIDAL MOTIVE POWER.—Walter R. Close, Bangor, Me.
110,437.—DIE PLATE FOR SCREW-CUTTING DIES.—William T Cole, New York city.
110,438.—FOLDING CHAIR.—Francis Colton, Brooklyn, N. Y.
110,439.—FASTENING FOR NECK TIES.—William J. Cowing, Washington, D.C.
110,440.—MACHINE FOR GROOVING BLOCKS FOR WOOD PAVEMENTS.—Perley D. Cummings, Portland, Me.
110,441.—SELF-CLEANING LOCOMOTIVE SMOKE STACK.—Samuel M. Cummins and Henry Israel (assignors for one third their right to Ransom C. Wright), Allegheny, Pa.
110,442.—PRESS FOR HAY, COTTON, ETC.—Matthew G. Cunningham, Corsicana, Texas.
110,443.—HAY AND COTTON PRESS.—Joseph K. Davis, Monticello, S.C.
110,444.—CARRIAGE WINDOW.—James F. Doley, Binghamton, N.Y. Antedated Dec. 15, 1870.
110,445.—GRAIN SEPARATOR.—James W. Donaldson, Fairfield, Cal.
110,446.—SNOW PLOW FOR RAILWAYS.—Tiberius Dougherty, Philadelphia, Pa.
110,447.—COMBINED BROADCAST SEEDER AND CULTIVATOR.—Joseph E. Fargo, Lake Mills, Wis. Antedated Dec. 10, 1870.
110,448.—DEVICE FOR SIGHTING AND FIRING ORDNANCE.—George K. Farrington, Alcatraz, Cal., assignor to himself Lorenzo Hubbard, and C. W. M. Smith.
110,449.—LENS OR GLASS FOR HEAD LIGHTS.—Henry C. Felthousen, Buffalo, N.Y.
110,450.—BUSHING FOR WARP BEAMS.—Richard Ferguson, Louisville, Ky.
110,451.—SAW MILL.—Charles M. Flint, Hancock, N. H.
110,452.—DRIP ATTACHMENT FOR UMBRELLAS.—Thaddeus Fowler, Tottenville, N.Y.
110,453.—WASHING MACHINE.—Abram A. Gardner, Savannah, Mo.
110,454.—INCUBATOR.—Jacob Graves, Reading, and Henry Graves, Boston, Mass.
110,455.—POWER PRESS.—Albert D. Hamlin (assignor to Mays & Bliss), Brooklyn, N.Y. Antedated Dec. 22, 1870.
110,456.—FLOUR BOLT.—Cyrus T. Hanna, Keokuk, Iowa.
110,457.—LAWN MOWER.—Hubert C. Hart, Unionville, Conn.
110,458.—CORN PLANTER.—Charles Allen Haskell, Galena, Ill.
110,459.—CANAL LOCK MECHANISM.—George Heath Annapolis, Md.
110,460.—GAGE FOR TURNING CLOCK-WORK.—Harry F. Henderson and James E. Ladd, Bristol, Conn. Antedated December 24, 1870.
110,461.—NON-CONDUCTING COMPOUND FOR COATING STEAM BOILERS, ETC.—John Hessing, Paterson, N. Y.
110,462.—MACHINE FOR CUTTING THE ENDS OF HOOPS.—L. N. Hewes, Swansey, N. H.
110,463.—COMPOUND AND PROCESS OF REMOVING INCRUSTATIONS OF LIME FROM STEAM BOILERS, METALS, ETC.—J. Austin Hewett, Nora Springs, Iowa.
110,464.—LAMP.—Charles F. A. Hinrichs, New York city.
110,465.—MANUFACTURE OF LEATHER.—F. A. Holcomb, Grand Rapids, Mich., assignor to himself and S. B. Jenks.
110,466.—PROPULSION OF CANAL BOATS.—Julius L. Hornig, Chicago, Ill.
110,467.—FIRE-BOX FOR STOVES AND RANGES.—Marcus L. Horton, Windsor, Vt.
110,468.—DEVICE FOR FILLING LOWLANDS.—George Howell, Philadelphia, Pa. Antedated December 9, 1870.
110,469.—REFINING OIL FROM COTTON-WASTE, ETC.—Edgar T. Jarrold, Tottenville, assignor, by mesne assignments, to himself, Henry S. Gerow, and Henry McLean, New York city.
110,470.—MEDICAL COMPOUND FOR RHEUMATISM.—Nathaniel Jenkins, New Orleans, La.
110,471.—SPRING BED BOTTOM.—W. B. Judson, Poughkeepsie, N. Y., assignor to I. P. Nelson, Jr.
110,472.—BASE-BURNING STOVE.—William Kaiser, Wilkesbarre, Pa. Antedated December 17, 1870.
110,473.—SPICE BOX.—E. S. Kennedy, Birmingham (Buchanan Postoffice), Pa.
110,474.—SCYTHE FASTENING.—Samuel U. King, Windsor, Vt.
110,475.—SMUT MACHINE.—William H. Kite and George S. Newman, Liberty Mills, Va.
110,476.—ATTACHMENT FOR RATLINS.—John Calef Knowlton, Rockport, Mass.
110,477.—VINE AND WEED CUTTER.—Harry Lawrence, New York city.
110,478.—WASHING MACHINE.—Balaam C. Lawson, Yolo county, Cal.
110,479.—KNITTING MACHINE.—John Lee, Mark Lee, and William Carter, Needham, Mass.
110,480.—NEEDLES AND THEIR CARRYING ARMS FOR SEWING MACHINES.—George A. Lloyd, San Francisco, Cal., assignor to himself, G. W. Smiley, James McMeehan, and Anthony Rosenfeld.
110,481.—COMPOUND FOR CLEANING CARPETS.—Leo. Marks, Cincinnati, Ohio.
110,482.—WASHING MACHINE.—Moses S. Marshall, Somerville, assignor to John T. Folsom and J. S. Folsom, Boston, Mass.
110,483.—CONSTRUCTION OF PRISONS.—Edwin May, Indianapolis, Ind.
110,484.—WATER FAUCET.—Pierre A. Mayor, New York city.
110,485.—CAMP BEDSTEAD.—Amos D. McCoy, Alexandria, La. Antedated Dec. 16, 1870.
110,486.—AUTOMATIC DOOR BOLT.—Angus McKay, Montreal, Canada.
110,487.—CHURN DASHER.—James B. Mellor, New Hope, Mo.
110,488.—FILTER TANK AND OTHER VESSELS USED FOR REFINING SIRUPS, SUGAR, ETC.—William Moller, Irvington, N. Y.
110,489.—TREATING BESSEMER STEEL.—James Myers, Jr., Williamsburgh, N. Y.
110,490.—BALANCED SLIDE VALVE.—John Nesbitt, Concord, N. H.
110,491.—KEY FOR LOCKS.—Webster Park, Norwich, Conn. Antedated December 15, 1870.
110,492.—GRAIN BINDER.—La Fayette Parker, Davenport, Iowa.
110,493.—Suspended.
110,494.—COUNTERSINK.—Moses Magoon Pettes, Worcester, Mass.
110,495.—CLEANING WOOL, COTTON, ETC.—Goldsbury H. Pond, Rutland, Vt.
110,496.—GAS RETORT AND HEATING FURNACE.—Goldsbury H. Pond, Rutland, Vt.
110,497.—RAILWAY CAR SPRING.—Albert Potts, Philadelphia, Pa.
110,498.—GRAIN BINDER.—F. W. Randall, Tekonsha, Mich. Antedated December 17, 1870.
110,499.—LOCK NUT.—James L. Randolph, Berkeley Springs, West Va.; assignor to G. L. Denny, Christiana, Pa.
110,500.—NAIL FOR PICTURES, ETC.—Thomas C. Richards, New York city.
110,501.—PROPELLING APPARATUS FOR CARS.—John Roy, New Orleans, La.
110,502.—HANDLE FOR BARRELS, ETC.—Minot S. Schofield, Stamford, Conn.
110,503.—WHIP-HOLDER FOR CARRIAGES.—Erastus W. Scott, Wauregan, Conn.
110,504.—BOTTLE-FILLING APPARATUS.—Thomas Simmons and David H. Lowe, Brooklyn, N. Y. Antedated December 16, 1870.
110,505.—BREECH-LOADING FIRE-ARM.—James Smiles, Birmingham, England.
110,506.—PLOW.—A. C. Smith, Joyner's Depot, N. C.
110,507.—CABINET FOR SEWING MACHINES.—J. E. Smith (assignor to himself and Julius Ludwig), Chicago, Ill.
110,508.—EYELET MACHINE.—S. N. Smith (assignor to the Union Eyelet Company), Providence, R. I.
110,509.—BUCK SAW.—A. B. Sprout, Muncy, Pa.
110,510.—KEY FOR SHAFTING.—Nathan Stedman, Aurora, Ind.
110,511.—BAG HOLDER.—A. D. Swogger, Worth, Pa.
110,512.—TURN-UP SEAT FOR CHURCHES, ETC.—J. P. Tibbits, New York city.
110,513.—CARRIAGE BOW.—I. N. Topliff, Adrian, Mich.
110,514.—POTATO DIGGER.—William Tripp, Mechanicsville, N. Y.
110,515.—MACHINE FOR HEADING RIVET AND SCREW BLANKS.—V. De M. Upham, Brooklyn, N. Y. Antedated December 10 1870.
110,516.—STILL FOR PETROLEUM AND OTHER OILS.—S. Van Syckel, Titusville, Pa.
110,517.—(Suspended.)
110,518.—HORSE COLLAR PAD.—J. F. Walsh, Hazel Green Wis.
110,519.—TOY HOOP.—Rivera Ward, Newark, N. Y.
110,520.—ADDING MACHINE.—F. F. Warner, Chicago, Ill.
110,521.—WINDLASS.—Enos Waterbury and G. N. Waterbury (assignors to G. N. Waterbury and A. M. Prior), Stamford, Conn.
110,522.—PRINTERS' INKING ROLLER.—C. S. S. Westcott, Elizabeth, N. J., assignor to himself, John Austin, Rollin Germain, New York city, and W. H. H. Williams, Middletown, Conn. Antedated Dec. 17, 1870.
110,523.—ROLLER-LIFTING POWER.—Elisha Whitcomb Waterville, Ohio.
110,524.—LOOM.—Robert Whitehill (assignor to the Positive Motion Loom Company), New York city.
110,525.—SUBSOIL PLOW.—T. G. Wilder, Camden, Miss.
110,526.—LAMP.—T. S. Williams (assignor to himself and P S. Page), Boston, Mass.
110,527.—SEAT-GUARD FOR HOBBY HORSES.—W. L. Williams New York city. Antedated December 17, 1870.
110,528.—RUNNING GEAR FOR CARRIAGES.—J. B. Withey Detroit, Mich.
110,529.—MACHINE FOR MAKING BRUSHES.—O. D. Woodbury, New York city.
110,530.—BORING MACHINE.—E. J. Worcester, Worcester, Mass.
110,531.—COTTON CULTIVATOR, SCRAPER, AND CHOPPER.—J. H. W. Young, Henderson, Texas.
110,532.—WOOD-SCREW MACHINE.—J. M. Alden (assignor to the International Screw-nail Company), New York city.
110,533.—TREADLE.—A. M. Allen, New York city.
110,534.—COPE FOR CASTING CAR WHEELS.—Albert Alling, Chicago, Ill.
110,535.—THREAD GUIDE AND HOLDER FOR BOBBIN-WINDING MACHINE.—W. W. Altemus, Philadelphia, Pa.
110,536.—PAPER-BAG MACHINE.—C. F. Annan, Boston, assignor to himself and H. S. Merrill, Cambridge, Mass.
110,537.—ADJUSTABLE CAM.—C. F. Annan, Boston, assignor to himself and H. S. Merrill, Boston, Mass.
110,538.—PORTABLE STORE ROOM AND PANTRY.—T. A. Barrell, Maroa, Ill.
110,539.—COTTON-BALE TIE.—G. N. Beard, St. Louis, Mo.
110,540.—MACHINE FOR DRYING PAPER AND OTHER FABRICS.—Frederick Beck, New York city.
110,541.—HORSE YOKE.—A. B. Beaumont, Austerlitz, Mich.
110,542.—GRAIN THRASHER, SEPARATOR, AND CLEANER.—E. M. Birdsall, Penn Yan, N. Y.
110,543.—SIFTER.—S. O. Blanding, Vineland, N. J.
110,544.—WATER WHEEL.—J. W. Bookwalter, Springfield Ohio.
110,545.—COMBINED IMMERSION AND STEAM BATH.—J. W Caldwell, Cincinnati, Ohio.
110,546.—BRIDGE.—A. McD. Campbell, Newark, N. J., assignor to himself, C. M. Bolen, and F. K. Day.
110,547.—ANNUNCIATOR.—Jacob Capron, New York city.
110,548.—CULTIVATOR.—J. H. Carlow, Kidder, Mo.
110,549.—COTTON PRESS.—Nash Cheek, Chapel Hill, N. C.
110,550.—PLOW.—Josiah Clifton, Georgetown, Texas.
110,551.—CLOTHES DRYER.—E. B. Corby, Bloomfield, N. J.
110,552.—TRUNK.—F. K. Daggett, Boston, Mass.
110,553.—PREVENTING INCRUSTATION OF STEAM BOILERS.—C. J. A. Dick, Paris, France.
110,554.—LAND ROLLER.—James W. Dilley, Macomb, Ill.
110,555.—WASHING MACHINE.—William J. Dodge, Syracuse N. Y.
110,556.—DRAWING FRAME.—George Draper, Hopedale Mass.
110,557.—FASTENING CARRIAGE WHEELS.—Wilson Elder Mill Hall, Pa.
110,558.—CARRIAGE BUTTON.—Charles H. Field, Providence, R. I.
110,559.—DISH WASHER.—Ruth Filson, Robert D. S. Filson, and John D. Cope, Xenia, Ill.
110,560.—PERMUTATION LOCK.—Charles Flesch, Rochester N. Y.
110,561.—CHILD'S CARRIAGE.—Isaac N. Forrester, Bridgeport Conn.
110,562.—TREATING HIDES AND MANUFACTURING LEATHER.—William H. Fuller, Brockport, assignor to himself and G. J. Kingsbury, Rochester, N. Y.
110,563.—CAR WHEEL.—William Goodman, Boston, Mass.
110,564.—APPARATUS FOR RAISING VESSELS.—J. E. Gowen, Boston, Mass.
110,565.—HAND CORN HUSKER AND SHELLER.—J. M. Gray, Louisville, Ky.
110,566.—COOKING RANGE.—William Hall, Quincy, Ill.
110,567.—METAL ROOF FOR BUILDINGS.—John S. Haywood, Rochester, Minn.
110,568.—HARVESTER.—George F. Hawley, Grand Rapids, Mich.
110,569.—MECHANISM FOR OPERATING SEWING MACHINES.—Elijah Leavitt Howard, Malden, assignor to G. A. Whiting, Charlestown, Mass.
110,570.—HAT.—George Johnson, Philadelphia, Pa.
110,571.—SLEIGH.—Alvarado Jones, Randolph, Wis.
110,572.—TRACE BUCKLE.—Wm. W. Kittleman, Bloomfield Iowa.
110,573.—MACHINE FOR COOLING AIR AND FOR THE MANUFACTURE OF ICE.—Julius Kraffert, Hoboken, N. Y.
110,574.—FELTING MACHINE.—C. P. Ladd (assignor to himself and J. T. Sanford), New York city.
110,575.—TRUNK.—John G. Lane, St. Louis, Mo.
110,576.—CURRYCOMB.—William E. Lawrence, New York city.
110,577.—IRONING TABLE.—John Jacob Marki (assignor himself, Wm. H. Lotz, and Carl Beer), Chicago, Ill.
110,578.—FOLDING LOUNGE.—Michael Marso, Chicago, Ill.
110,579.—AXLE SKEIN.—Lorenzo Mayhew, Saratoga Springs N. Y.
110,580.—CAR COUPLING.—Wm. H. Meadows, McMinnville Tenn.
110,581.—CARRIAGE CLIP.—F. B. Morse (assignor to himself and H. D. Smith & Co., Plantsville, Conn.
110,582.—MATERIAL FOR BEARINGS AND PACKINGS.—Eliza D. Murfey (assignor to the Manhattan Packing Manufacturing Company,) New York city.
110,583.—BEARING AND PACKING MATERIAL.—Eliza Dexter Murfey (assignor to the Manhattan Packing Manufacturing Company,) New York city.
110,584.—THE MANUFACTURE OF MATERIALS FOR JOURNALS, BEARINGS, AND PACKINGS.—Eliza D. Murfey (assignor to the Manhattan Packing Manufacturing Company), New York city.
110,585.—HAY AND OTHER PRESSES.—Moses V. Northrup, Hornitos, Cal.
110,586.—MACHINE FOR DRESSING FENCE PICKETS.—Wm. Nuelle and J. F. Nuelle, St. Louis, Mo.
110,587.—FINGER RING.—John S. Palmer, Providence, R. I.
110,588.—COOKING STOVE.—Miles Pratt, Watertown, Mass.
110,589.—BROILER AND TOASTER.—J. M. Read and J. M. Smith, Boston, Mass.
110,590.—SHAFT COUPLING.—Peter W. Reinshagen (assignor to himself and John H. Buckman), Cincinnati, Ohio.
110,591.—LAMP WICK.—Daniel T. Robinson, Boston, Mass.
110,592.—LAWN MOWER.—Luther Ross, Worcester, Mass.
110,593.—CORSET FASTENING.—Christian Schieck, New York city.
110,594.—TOBACCO PIPE.—William Selfe, Cincinnati, Ohio.
110,595.—SEED SOWER.—S. H. Sheplar, San Francisco, Cal. and Wm. G. Conklin, Portland, Oregon.
110,596.—CARPENTERS' GAGE.—H. P. Sisson, Rutland, Vt.
110,597.—COMBINED TRAMWAY AND PAVEMENT.—B. C. Smith, Burlington, N. J.
110,598.—CHAIR FRAME.—William Merion Smith, Columbus, Ohio.
110,599.—PORTABLE SHIELD FOR INFANTRY AND ARTILLERY—Harde Spears, Snow Hill, Cal.

110,600.—Life Boat.—James M. Starr, Fond Du Lac, Wis.
110,601.—Malt Reservoir.—Charles Stoll, Brooklyn, N. Y.
110,602.—Safety Attachment for Railway Trucks.—Arnold Strauss, New York city.
110,603.—Pocket Brush.—Theodore F. Stumpf, New York city.
110,604.—Steam Boiler.—Frederick Sulter, Cleveland, Ohio.
110,605.—Grain Register.—William Z. Taylor (assignor to himself and John R. King), Burlington, Iowa.
110,606.—Carriage.—Chauncey Thomas, Boston, Mass.
110,607.—Clothes Dryer.—William Tredenick, Providence, R. I.
110,608.—Pepper and Spice Box.—A. E. Turnbull, Jr., Clifton, Ohio, assignor to Joseph H. Steele, New Haven, Conn.
110,609.—Machine for Cutting and Shaping Metals.—Claus Van Haagen (assignor to himself and Anthony Van Haagen), Philadelphia, Pa.
110,610.—Compound for Treating Leather.—Samuel S. Walbank, Superior City, Wis.
110,611.—Tap for Oil Package.—Albin Warth, Stapleton, N. Y.
110,612.—Tap for Oil-Package.—Albin Warth, Stapleton, N. Y.
110,613.—Grain Rake.—Marcus M. Wells, Hartwick, N. Y.
110,614.—Watch Regulator.—Charles V. Woerd, Waltham, Mass.
110,615.—Fur-set Box.—Clinton W. Frazer, Brooklyn, N. Y.
110,616.—Churn.—Joseph O. Maclaskey (assignor to himself and James E. Tyrrell), Perth Amboy, N. J.

REISSUES.

4,215.—Hoisting Block.—Joseph A. Burr, Brooklyn, assignor to Burr & Co., New York city.—Patent No. 108,446, dated October 18, 1870.
4,216.—Shovel Plow and Potato-Digger Combined.—James Milien Dick (assignor to himself and William H. Albro), Buffalo, N. Y.—Patent No. 105,922, dated August 2, 1870.
4,217.—Division B.—Harvester.—Rufus Dutton, Yonkers, N. Y.—Patent No. 31,378, dated February 12, 1861; reissue No. 4,125, dated September 20, 1870.
4,218.—Broiler.—James T. Page, Rochester, N. Y.—Patent No. 106,280, dated August 9, 1870.
4,219.—Reservoir Cooking Stoves.—George H. Phillips, Troy, N. Y.—Patent No. 86,585, dated February 2, 1869.
4,220.—Water-pipe Machine.—John W. Stockwell, Portland, Maine.—Patent No. 106,424, dated August 16, 1870.
4,221.—Lamp Chimney.—The Requa Patent Concave Burner and Chimney Company, New York city, assignee of E. B. Requa.—Patent No. 37,773, dated February 24, 1863.
4,222.—Gang Plow.—George W. Hildreth, Lockport, N. Y.—Patent No. 18,397, dated October 13, 1857.

DESIGNS.

4,535.—Fruit-Gatherer.—James S. Barry and Alfred M. Barry, Albion, Mich.
4,536 and 4,537.—Back of a Playing Card.—Solomon L. Cohen (assignor to Lawrence & Cohen), New York city. Two Patents.
4,538 and 4,539.—Oil-Cloth Pattern.—Henry Kagy (assignor to Thomas Potter, Son & Co.), Philadelphia, Pa. Two Patents.
4,540.—Carpet Pattern.—Hugh S. Kerr (assignor to Israel Foster), Philadelphia, Pa.
4,541.—Railway Car Sash Lock.—William H. Paige, Springfield, Mass.
4,542.—Poultry Fountain.—Beekman Van Gaasbeek, Mount Vernon, N. Y.
4,543.—Chain.—Josiah V. Waldron and Charles F. Waldron, New York city.
4,544 and 4,545.—Oil-cloth Pattern.—John T. Webster, New York city, assignor to Thomas Potter, Son & Co., Philadelphia, Pa. Two Patents.
4,546.—Case of a Parlor Organ.—George Woods, Cambridge, Mass.

TRADE-MARKS.

112.—Whiskey.—H. Block & Co. Cincinnati, Ohio.
113.—Burning Fluid.—George M. Danforth, New York city.
114.—Honolulu Orange Bitters.—Robert Des Auges, New York city.
115 and 116.—Fertilizer.—Dugdale & Girvin, Baltimore, Md. Two patents.
117.—Lead Pencils.—Eberhard Faber, New York city.
118.—Furnishing Goods.—Fisk, Clark & Flagg, New York city.
119.—Liquors.—Charles H. Ross & Co., Baltimore, Md.
120.—Medical Compound.—Samuel S. Seely, Bath, N. Y.
121.—Burning Fluid.—Philip Weisenberger, Pittsburgh, Pa.

EXTENSIONS.

Machine for Grinding Saws.—Emanuel Andrews, of Williamsport, Pa.—Letters Patent, No. 16,222, dated December 16, 1856; reissue No. 2,290, dated June 19, 1866.
Paper-pulp Engine.—Joseph Kingsland, Jr., of Franklin, N. J.—Letters Patent No. 16,278, dated December 23, 1856.
Machine for Grinding Paper Pulp.—Joseph Kingsland, Jr., of Franklin, N. J.—Letters Patent No. 16,239, dated December 16, 1856; reissue No. 745, dated June 28, 1859; reissue No. 1,330, dated January 6, 1863.
Process of Grinding Paper Pulp.—Joseph Kingsland, Jr., of Franklin, N. J.—Letters Patent No. 16,316, dated December 23, 1856; reissue No. 744, dated June 28, 1859; reissue No. 1,331, dated January 6, 1863.

BAIRD'S Industrial LITERATURE.

LIST NO. 2.

Chapman.—A Treatise on Rope Making. By Robert Chapman. 24mo....$1 50
Colburn.—The Gas Works of London. By Zerah Colburn. 8vo....75
Colburn.—The Locomotive Engine. By Zerah Colburn. 12mo....$1 25
Colburn and Maw.—The Water Works of London. By Zerah Colburn and W. Maw. Plates. 8vo....$4 00
Craik.—The Practical American Millwright and Miller. By David Craik, Millwright. Numerous wood engravings and folding plates. 8vo....5 00
Daguerreotypists' and Photographers' Companion. 12mo....$1 25
Dircks.—Perpetual Motion. By Henry Dircks. Illustrated. 12mo....$3 50
Dixon.—The Practical Millwright's and Engineer's Ready Reckoner. By Thomas Dixon. 12mo. $1 50
Duncan.—Practical Surveyor's Guide. By Andrew Duncan. 12mo....$1 25
Dussauce.—A New and Complete Treatise on the Arts of Tanning, Currying, and Leather Dressing. By Prof. H. Dussauce. 212 wood engravings. 8vo. $10 00
Dussauce.—A General Treatise on the Manufacture of every description of Soap. By Prof. H. Dussauce. Illustrated. 8vo....$10 00
Dussauce.—A practical Guide for the Perfumer. By Prof. H. Dussauce. 12mo....$3 00
Dussauce.—Practical Treatise on the Fabrication of Matches, Gun Cotton, and Fulminating Powders. By Prof. H. Dussauce. 12mo....$3 00
De Graff.—The Geometrical Stair Builder's Guide. By Simon De Graff. 22 steel plates. 4to..$5 00
Dyer and Color Maker's Companion. 12mo. $1 25
Easton.—A Practical Treatise on Street or Horse-power Railways. By Alex. Easton. 23 plates. $2 00
Fairbairn.—The Principles of Mechanism and Machinery of Transmission. By Sir William Fairbairn, Bart. 150 wood cuts. 12mo....$2 50
Gesner.—A Practical Treatise on Coal, Petroleum, and other Distilled Oils. By George W. Gesner. 8vo....$3 50
Gilbart.—A Practical Treatise on Banking. By James William Gilbart. 8vo....$4 50
Gothic Album for Cabinet Makers. 23 large plates. Oblong....$3 00
Grant.—Beet-root Sugar and Cultivation of the Beet. By E. B. Grant. 12mo....$1 25
Gregory.—Mathematics for Practical Men. By Olinthus Gregory. Plates. 8vo....$3 00
Griswold.—Railroad Engineer's Pocket Companion for the Field. By W. Griswold. 12mo. Tucks....$1 75
Hats and Felting. By a Practical Hatter. 8vo....$1 25
Hay.—The Interior Decorator. By D. R. Hay. 12mo....$2 25
Hughes.—American Miller and Millwright's Assistant. By William Carter Hughes. Illustrated. 12mo....$1 50
Hunt.—The Practice of Photography. By Robert Hunt. 12mo....75
Hurst.—A Handbook for Architectural Surveyors and others engaged in Building. By J. F. Hurst. 2d edition, pocketbook form....$2 50
Jervis.—Railway Property. By John B. Jervis. 12mo....$2 00
Johnson.—A Report to the Navy Department of the United States on American Coals. By Walter R. Johnson. 8vo, half mor....$10 00
Johnston.—Instructions for the Analysis of Soils, Limestones, and Manures. By J. F. W. Johnston. 12mo....38
Keene.—A Handbook of Practical Gaging. By James B. Keene. 8vo....$1 25
Kentish.—Treatise on a Box of Instruments and the Slide Rule. By T. Kentish. 12mo....$1 25
Kobell.—Erni.—Mineralogy Simplified. By F. Von Kobell and Henri Erni. 12mo....$2 50
Landrin.—A Treatise on Steel. By A. A. Fesquet. 12mo....$3 00
Larkin.—The Practical Brass and Iron Founder's Guide. By James Larkin. 12mo....$2 25
Leavitt.—Facts about Peat as an Article of Fuel. By T. H. Leavitt. 12mo....$1 75
Leroux.—A Practical Treatise on the Manufacture of Worsteds and Carded Yarns. By A. A. Fesquet. 12 plates. 8vo....$5 00

☞ The above or any of my Books sent by mail, free of postage, at the publication prices. My new revised and enlarged **Catalogue of Practical and Scientific Books**, 82 pp. 8vo, now ready, complete to Dec. 15, 1870, will be sent, free of postage, to any one who will favor me with his address.

HENRY CAREY BAIRD,
INDUSTRIAL PUBLISHER,
406 Walnut st., Philadelphia, Pa.

No
LIVE MECHANIC
Can afford to be without some of
BAIRD'S BOOKS
FOR PRACTICAL MEN.

My new and enlarged Catalogue of PRACTICAL AND SCIENTIFIC BOOKS, 82 pages, 8vo., will be sent, free of postage, to any one who will favor me with his address.

HENRY CAREY BAIRD,
Industrial Publisher, 406 Walnut St.,
PHILADELPHIA.

Buy Barber's Bit Brace

Printing Machinery.

VICTOR E. MAUGER

OFFERS to Printers, Lithographers, Paper Makers, Bookbinders, Manufacturing Stationers, and the kindred trades, some of the most perfect Improved Machinery known to the trade, and which, both for quality and moderate price, cannot fail to give satisfaction.

His list comprises:

Letter Press Machines.

The celebrated **WHARFEDALE ORDINARY**, for fine Book and Job Work.

The **TUMBLING WHARFEDALE**, for printing Newspapers of limited circulation, up to 2,500 impressions an hour.

The **SPECIAL COLOR WHARFEDALE**, for the finest description of Cut and Color Work.

The **TWO-COLOR WHARFEDALE**, for printing two colors simultaneously.

The **WHARFEDALE TWO-FEEDER**, single cylinder, fast news press, for fine and illustrated news work, such as the *Graphic* and *Scientific American*, which are both printed on this machine; speed 4,000 an hour.

The **WHARFEDALE FOUR-FEEDER**, or Two Cylinder Double Feeder, capable of a speed from a flat bed of about 7,000 per hour.

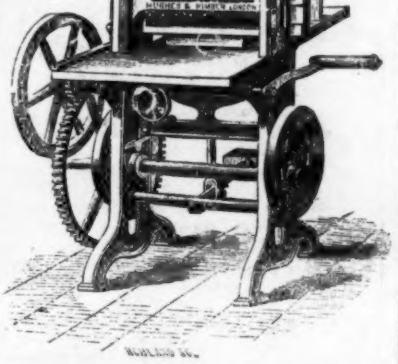
HUGHES & KIMBER'S LITHOGRAPHIC PRINTING MACHINE,

the pioneer and best and fastest Cylinder Lithographic Press.

TANGYE'S
PATENT HYDRAULIC PRESSES,

powerful, simple, and economical, furnished with fast and slow pump, and made in every variety of size.

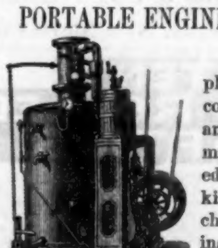
GUILLOTINE
PAPER CUTTING MACHINE,



The most durable, accurate, and highly finished cutter made. All sizes, cutting from 12 to 42 inches.

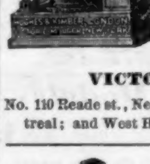
MILLBOARD CUTTING MACHINES,
PAPER GLAZING MACHINES,
PAPER MAKERS' CALENDERS,
COPPER-PLATE PRESSES,
Round-Hole Perforating Machines,
Paging Machines,
Numbering Machines,
Bronzing Machines,
Stone-Grinding Machines.

HUGHES & KIMBER'S
FIRST PREMIUM
PORTABLE ENGINE AND BOILER.



The strongest, simplest, cheapest, most compact, economical, and handsome engine made. Specially adapted for driving all kinds of Printers' machinery, and for hoisting and pumping purposes.

VICTOR E. MAUGER,
No. 110 Reade st., New York; No. 82 St. Peter st., Montreal; and West Harding st., Fetter Lane, London.



Reynolds'
TURBINE WATER WHEELS.
The Oldest and Newest. All others only imitations of each other in their strife after complications to confuse the public. We do not boast but quietly excel them all in staunch reliable, economical power. Beautiful pamphlet free. GEO. TALLCOT, 96 Liberty st., New York.
Gearing, Shafting.

Gear's Variety Molding
Machine is the best in the world. Send for Circular.
A. S. & J. Gear & Co., Boston, Mass.
☞ CAUTION.—It is an infringement to use the N. Y. V. Machine anywhere except in New York. Take Notice. We mean business.

PATENT RIGHTS SOLD ON COMMISSION.
By E. E. ROBERTS & CO., Consulting Engineers, 15 Wall St., N. Y. Send Stamp for Circular.

Niagara Steam Pump.
CHAS. B. HARDICK,
Adams st., Brooklyn, N. Y.

BUERK'S WATCHMAN'S TIME DETECTOR.—Important for all large Corporations and Manufacturing concerns—capable of controlling with the utmost accuracy the motion of a watchman or patrolman, as the same reaches different stations of his beat. Send for a Circular. J. E. BUERK,
P. O. Box 1,057 Boston, Mass.
N. B.—This detector is covered by two U. S. Patents. Parties using or selling these instruments without authority from me will be dealt with according to law.

WROUGHT IRON BEAMS & GIRDERS

THE Union Iron Mills, Pittsburgh, Pa. The attention of Engineers and Architects is called to our improved Wrought-iron Beams and Girders (patented), in which the compound welds between the stem and flanges, which have proved so objectionable in the old mode of manufacturing, are entirely avoided, we are prepared to furnish all sizes at terms as favorable as can be obtained elsewhere. For descriptive lithograph address the Union Iron Mills, Pittsburgh, Pa.

RUMPFF & LUTZ,
IMPORTERS and Manufacturers of Aniline Colors and Dyestuffs, Colors for Paperhangers and Stainers. Reliable recipes for Dyeing and Printing on Silk, Wool, and Cotton. All new improvements in the art of Dyeing, and new Colors are transmitted to us by our friends in Europe, as soon as they appear.
42 Beaver street, New York.

IMPORTANT
TO MACHINISTS.—The Best Metal for all Machine Uses is the MARTIN STEEL, made by THE NEW JERSEY STEEL AND IRON CO., Trenton, N. J. This steel is made by an entirely different process from any other, and is tougher than wrought iron. It can be turned without annealing, being entirely free from hard spots. Every one who uses it pronounces it just what they have long wanted, for a multitude of uses, such as Crank Pins, Lathe Spindles and Screws, Cotton Machinery Rollers, Saw and Fan Spindles, etc., etc. Also, particularly adapted for Firebox Plates. Prices low. Send for further information, or a sample, stating use to which it is to be applied.

STEAM Gages, large assortment, self-testing, & original Ashcroft steam gage. E. H. Ashcroft, Boston.

AGENTS WANTED—($225 A MONTH) by the AMERICAN KNITTING MACHINE CO., Boston, Mass., or St. Louis, Mo.

L. W. Pond's New Tools.
NEW AND IMPROVED PATTERNS—Lathes, Planers, Drills, Milling Machines, Boring Mills, Gear and Bolt Cutters, Punches and Shears for Iron. Office

98 9 Ate 98

Liberty st., New York. Works at Worcester, Mass.

MODELS, PATTERNS, EXPERIMENTAL, and other machinery, Models for the Patent Office, built to order by HOLSKE MACHINE CO., Nos. 528, 530, and 532 Water st., near Jefferson. Refer to SCIENTIFIC AMERICAN office. 14 tf

---

THE BEST PUNCHING PRESSES ARE made by the Inventor and Patentee of the famous Eccentric Adjustment. Infringements upon said Patent will be severely dealt with. N. C. STILES,
Middletown, Conn.

Agents! Read This!
WE WILL PAY AGENTS A SALARY of $30 per week and expenses, or allow a large Commission, to sell our new and wonderful inventions. Address M. WAGNER & CO., Marshall, Mich.

1832. SCHENCK'S PATENT. 1870.
Woodworth Planers.
And Re-Sawing Machines, Wood and Iron Working Machinery, Engines, Boilers, etc. JOHN B. SCHENCK & SON, Matteawan, N. Y., and 118 Liberty st., New York.

WANTED—AGENTS, $20 PER DAY, TO sell the celebrated HOME SHUTTLE SEWING MACHINE. Has the under-feed, makes the "lock stitch" alike on both sides, and is fully licensed. The best and cheapest Family Sewing Machine in the market. Address
JOHNSON, CLARK & CO.,
Boston, Mass.; Pittsburgh, Pa.; Chicago, Ill., or St. Louis, Mo.

Milling Machine,
INDEX, STANDARD, UNIVERSAL, AND HORIZONTAL.—The largest variety to be found in the country, on hand and finishing. Workmanship, Material, and Design unsurpassed. Machines on exhibition at Fair of American Institute. UNION VISE CO. OF BOSTON. Office 80 Milk st. Works at Hyde Park, Mass.

ONE DIME will secure by return mail copies of the BRIGHT SIDE, the cheapest, most attractive, and most popular young people's paper in the world (all stories complete), worth three times the money. Splendid premiums, and large cash commissions to agents. Order at once.
JOHN B. ALDEN & CO., Publishers, Chicago, Ill.

EVERY MAN HIS OWN PRINTER. With one of our presses, and the material accompanying it, every man can do his own printing, thus saving much time and expense. Circulars containing full information about these presses, prices, recommendations, &c., mailed free on application. Specimen-books of types, cuts, borders, &c., &c., 10 cents. ADAMS PRESS CO., 53 Murray street, New York.

CINCINNATI BRASS WORKS.—Engineers and Steam Fitters' Brass Work, Best Quality at very Low Prices. F. LUNKENHEIMER, Prop'r.

Vertical Corn Mills,
AND COMBINED
GRINDING & BOLTING MILLS.
For Flour, Fine Meal, Spices, Drugs, etc.
EDWARD HARRISON, New Haven, Conn.

FOR MALLEABLE IRON CASTINGS, and Patterns for same, address
McCONWAY, TORLEY & CO.,
809 Liberty st., Pittsburgh, Pa.

SILICATE OF SODA, IN ITS VARIOUS forms, manufactured as a specialty, by Philadelphia Quartz Co., 783 South 2d st., Philadelphia, Pa.

Andrew's Patents.
Noiseless, Friction Grooved, Portable, and Warehouse Hoisters.
Friction or Geared Mining & Quarry Hoisters.
Smoke-Burning Safety Boilers.
Oscillating Engines, Double and Single, 1-2 to 100-Horse power.
Centrifugal Pumps, 100 to 100,000 Gallons per Minute, Best Pumps in the World, pass Mud, Sand, Gravel, Coal, Grain, etc., without injury.
All Light, Simple, Durable, and Economical.
Send for Circulars.
WM. D. ANDREWS & BRO.,
414 Water street, New York.

U. S. PIANO CO. N. Y. Best in the World—$290. Sent on trial—See large cut and terms in Scientific American. Oct. 1st. 1870.

MACHINERY, NEW and 2d-HAND.—Send for Circular. CHAS. PLACE & CO., 60 Vesey st., New York.

1826 USE THE VEGETABLE PULMONARY BALSAM. **1870**
The old standard remedy for Coughs, Colds, Consumption. "Nothing Better." CUTLER BROS. & Co., Boston.

$15,000 A YEAR.
WANTED—AGENTS—To sell the Universal Sewing Machine, size, 12-in. long by 8 in hight, of great capacity and durability, works on a new principle. Price, complete, $15, sent C.O.D.
UNIVERSAL S. M. CO.,
58 Bromfield street, Boston, Mass.

---

8 O'CLOCK.

P. BLAISDELL & CO.,
BUILDERS OF A NEW PATTERN 12-in. Swing Lathe, designed for Sewing Machine Works, the "Blaisdell" Patent Drill Presses and other first-class Machinists' Tools, Jackson street, Worcester, Mass.

THE WOODWARD STEAM-PUMP MANUFACTURING COMPANY, Manufacturers of the Woodward Pat. Improved Safety Steam Pump and Fire Engine, Steam, Water, and Gas Fittings of all kinds. Also Dealers in Wrought-iron Pipe, Boiler Tubes, etc. Hotels, Churches, Factories, & Public Buildings heated by Steam, Low Pressure. Woodward Building, 76 and 78 Center st., cor. of Worth st. (formerly of 77 Beekman st., N. Y. All parties are hereby cautioned against infringing the Pat. Right of the above Pump. G. M. WOODWARD, Pres't.

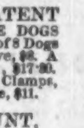
WOODBURY'S PATENT
Planing and Matching
and Molding Machines, Gray & Wood's Planers, Self-oiling Saw Arbors, and other wood working machinery.
S. A. WOODS, { 91 Liberty street, N. Y.;
Send for Circulars. { 67 Sudbury street, Boston.

RICHARDSON, MERIAM & CO., Manufacturers of the latest improved Patent Daniels' and Woodworth Planing Machines, Matching, Sash, and molding, Tenoning, Mortising, Boring, Shaping, Vertical, and Circular Re-sawing Machines, Saw Mills, Saw Arbors, Scroll Saws, Railway, Cut-off, and Rip-saw Machines, Spoke and Wood Turning Lathes, and various other kinds of Wood-working Machinery. Catalogues and price lists sent on application. Manufactory, Worcester, Mass. Warehouse, 107 Liberty st., New York. 17 1

ROBERT McCALVEY, Manufacturer of HOISTING MACHINES AND DUMB WAITERS. 602 Cherry street, Philadelphia, Pa.

PORTABLE AND STATIONARY STEAM Engines and Hoisting Engines. A good article at low prices. Every machine warranted. Send for descriptive Price List. H. B. BIGELOW & CO., New Haven, Conn.

LECOUNT'S PATENT HOLLOW LATHE DOGS AND CLAMPS.—A set of 8 Dogs from ⅜ to 2-in., inclusive, $8. A set of 12 from ⅜ to 4-in., $17·20. Five sizes Machinists' Clamps, from 2 to 6-in., inclusive, $11. Send for Circular.
C. W. LECOUNT,
South Norwich, Conn.



PORTABLE STEAM ENGINES, COMBINING the maximum of efficiency, durability and economy, with the minimum of weight and price. They are widely and favorably known, more than **750** being in use. All warranted satisfactory or no sale. Descriptive circulars sent on application. Address
J. C. HOADLEY & CO., Lawrence, Mass.
46. Cortlandt st., New York.

PUMPS.—For Description, Price Lists, etc., of the Best Centrifugal Pump ever invented, with Overwhelming Testimony in its favor, send for new illustrated pamphlet (36 pp.) to Messrs. HEALD, SISCO & CO., Baldwinsville, N. Y.

SHINGLE AND HEADING MACHINE—Law's Patent with Trevor & Co.'s Improvements. The Simplest and Best in use. Also, Shingle, Heading and Stave Jointers, Equalizers, Heading Turners, Planers etc. Address TREVOR & CO., Lockport, N. Y.

THE NORTHAMPTON HAND PEGGING Machine Co., having ample facilities in connection with the manufacture of their machine, would like to engage in the manufacture of some light machine, or any small article of iron work for patentees or others. The best of reference given and required. D. C. ROGERS, Treasurer. Northampton, Mass., Nov. 22, 1870.

BRICKS. THE HOTCHKISS Brick Machine makes 20,000 bricks a day, which can be hacked immediately. It is simple, cheap, and durable. For making DRAIN TILE it is unrivaled. Can be seen working at Company's yard, Ridgefield, N. J. State, County, and Yard Rights for sale. Address FERRY FARM BRICK WORKS, (Room 7) No. 19, Cliff st., New York.

SCROLL SAW.—McChesney's, Patented March 16th and Nov. 1st, 1870. First Prize Fairs Am. Institute, 1869 and 1870, and Virginia State Fair, 1869. Send for circular and price. Wanted—Parties to manufacture on royalty, or would sell patent.
THOS. L. CORNELL, Derby, Conn.

VINEGAR.—How Made from Cider, Wine, Molasses, or Sorghum in 10 hours, without using drugs. For circulars, address F. I. SAGE, Vinegar Maker, Cromwell, Conn.

LATHE CHUCKS—HORTON'S PATENT from 4 to 36 inches. Also for car wheels. Address E. HORTON & SON, Windsor Locks, Conn.

WATER POWER for Rent or Sale.—The Ousatonic Water Co. offer fine Mill Sites, permanent Water Power, and unsurpassed facilities to manufacturers; only 3 hours from New York, with rail and water communication. Address Ousatonic Water Co., Derby, Ct.

PAT. Roller Chafe Iron for Carriages. Send for circular. D. W. Storer Bangor, Me.

$20 a day to Agents; 15 new articles, staple as flour. Samples free. C. M. Linington, Chicago